State of California
The Resources Agency
Department of Water Resources

RECREATION SAFETY ASSESSMENT
FINAL

R-2

Oroville Facilities Relicensing
FERC Project No. 2100

JANUARY 2004

ARNOLD SCHWARZENEGGER
Governor
State of California

MIKE CHRISMAN
Secretary for Resources
The Resources Agency

LINDA S. ADAMS
Director
Department of Water Resources

State of California
The Resources Agency
Department of Water Resources

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FERC Project No. 2100

This report was prepared under the direction of

Douglas Rischbieter .....Resource Area Manager, DWR

by

Bill Spain .....Environmental Planner, EDAW Inc.
Sergio Capozzi.....Environmental Planner, EDAW Inc.
Jonathan Childers .....Environmental Planner, EDAW Inc.
Chuck Everett..... Senior Environmental Planner, EDAW Inc.

REPORT SUMMARY

This document presents the results of the Recreation Safety Assessment, one of several recreation studies conducted to support Oroville Facilities Relicensing (Federal Energy Regulatory Commission [FERC] Project No. 2100). This study presents a quantitative and qualitative assessment of public safety as it relates to existing recreation activities within the study area, and develops proposed recommendations by the study plan authors to be considered during the relicensing process.

INTRODUCTION

This study report is divided into seven sections. The first is an introduction that provides background information about the Oroville Facilities, and information about agencies responsible for public safety. Section 2.0 (Need for the Study) addresses why the study is necessary to support relicensing. Section 3.0 (Study Objective) addresses the purpose of the study. Section 4.0 (Methodology) discusses how the data and information used in this study were obtained. Section 5.0 (Study Results and Analysis) incorporates the results of this study. Section 6.0 (Public Safety Considerations) lists potential public safety actions to be considered during relicensing to enhance recreation safety in the study area over the term of the new license. The final section lists the sources and references used to complete this study.

The California Department of Water Resources (DWR) commissioned this study as part of the relicensing process for the preparation of a license application to be submitted to the FERC for the Oroville Facilities. As part of this relicensing process, a series of related studies are being conducted to assess and evaluate recreation resources associated with the Oroville Facilities. This report presents the results of one of those studies: an evaluation of recreation safety in the study area, including Lake Oroville State Recreation Area (LOSRA), Oroville Wildlife Area (OWA), and other areas with a nexus to the Project.

Lake Oroville is the second largest reservoir in California, after Shasta Lake. The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in Northern California, the San Francisco Bay area, the San Joaquin Valley, and Southern California.

The Oroville Facilities support a wide variety of recreational opportunities. They include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment.

Several federal, State, and local agencies and services have public safety responsibilities in the study area. Without inferring any order of priority, they are:

- FERC
- United States Forest Service (USFS)
- Bureau of Land Management (BLM)
- California Department of Parks and Recreation (DPR)
- California Department of Fish and Game (DFG)
- DWR
- California Highway Patrol (CHP)
- California Department of Boating and Waterways (DBW)
- California Department of Forestry and Fire Protection (CDF)
- Butte County Sheriff's Office
- City of Oroville Police Department
- Feather River Recreation and Park District (FRRPD)
- First Responder

NEED FOR THIS STUDY

This study is needed because FERC regulations require that licensees develop a comprehensive recreation plan during the relicensing process for implementation over the term of the new license. Appropriate measures to enhance public safety will be incorporated into the development and operations and maintenance (O&M) programs of the plan. This study also addresses Issue Statement R2—adequacy of public safety at the study area recreation facilities.

STUDY OBJECTIVE

The objective of this study is to identify public recreation safety issues and concerns within the study area; the study also proposes recommendations to address these safety issues and concerns in the new license. This study assesses current and historic recreation-related safety incidents and trends, as well as recreation safety-related management policies, procedures, and facilities and equipment. Recreation safety is important to all visitors, recreation providers, and managers within the study area.

METHODOLOGY

A variety of methods were used to analyze and document recreation safety issues and concerns to develop proposed recommendations. Once this information was compiled and analyzed, proposed recommendations were developed.

The following methods were used to complete this study, and a discussion of each method is included below:

- Interviews with safety-related personnel
- Review of recreation surveys and safety issues
- Review of incident reports / accident statistics
- Field observations of potential hazards
- Cell phone coverage / radio communications
- Wildland fire safety

STUDY RESULTS AND ANALYSIS

Representatives of the primary agencies responsible for day-to-day recreation safety in the study area were interviewed. The goal of the interviews was to identify issues related to recreation safety from the point of view of law enforcement and land and resource managers. Representatives from the following responsible agencies were interviewed: DPR, DFG, Butte County Sheriff's Office, the City of Oroville Police Department, and First Responder (the local ambulance service). The following issues were reported (in no particular priority):

- Boaters often exceeding the 5 miles per hour (mph) limit in designated zones;
- Personal watercraft (PWC) users jumping wakes and following other boats too closely;
- Alcohol use while boating;
- Need for more enforcement officers to deal with boating safety issues;
- Boaters not wearing personal floatation device (PFD);
- Aquatic plants getting caught in the jets of PWC or jet boats;
- Daily water fluctuations at Thermalito Afterbay;
- Seasonal water level changes at Lake Oroville;
- Fights and assaults with deadly weapons at the Afterbay Outlet fishing area;
- Cases of hypothermia along the Feather River below the dam;
- Fires occurring frequently in the OWA and vegetation conditions creating various hazards for hunters and hikers in the area;
- No evacuation plan for the OWA in case of fire;
- DFG not being well-prepared for developed recreation management, despite areas within the OWA receiving heavy use comparable to developed recreation sites; and
- Illegal dumping within the study area, including cars, appliances, and items associated with methamphetamine labs.

Recreation user surveys were conducted and included questions related to recreation safety both within the study area and at similar sites in Northern California. These results provided valuable insight into the user experience with recreation safety in the study area. In general, a small fraction of the respondents identified behavior that put

them at risk while visiting the study area. PWC and boats being too close to other boaters were mentioned as the most common at risk behavior. About 7 percent of the respondents who identified themselves as trail users stated that they experienced an at-risk encounter while on a trail. The majority of both hunters and anglers stated that they were knowledgeable about the regulations and that the regulations allowed for a quality experience.

An evaluation of violations provided by DPR showed that vandalism and alcohol-related violations were the most common illegal activities in the LOSRA. In addition, information regarding boating accidents at Lake Oroville was obtained from DBW and DPR. The most common types of boating accidents were collisions with other vessels and skier mishaps. These two types of incidents also led to the most boating injuries. The only fatality reported from 1997 to 2002 was the result of a boat capsizing. There is no clear trend in the total number of accidents over the 6 years of reported accidents. With the exception of boats occasionally colliding and skier mishaps, other types of accidents appear to be fairly isolated incidents. As might be expected, the majority of accidents that occur at Lake Oroville are in the summer months. It is noteworthy that the number of accidents involving PWC use have declined since 1997. This suggests that new laws raising the minimum operating age and not allowing PWC users to jump waves close to other boats may have had a positive effect.

Radio and cellular phone coverage were examined in the study area by testing two major cellular providers' phones and both DPR and DWR communication radios. In general, radio communication is good within the study area. Cellular phone coverage is good in some areas, but there are several recreation sites and areas with intermittent or poor coverage.

Wildfire histories were also reviewed as part of this study. Very few of the recorded fires from the past 100 years occurred as a result of recreational use of the study area. However, many of the fires were caused by unknown or unidentified sources, some of which could potentially have been recreational use. CDF also tracks fire ignitions (cause, location, etc.), regardless if a wildfire of recordable size results. Since 1990, CDF has recorded nearly 400 fire ignitions in the study area. The most recorded cause of wildfire ignitions in the study area vicinity was the use of equipment. Using a CDF fuel hazard model, areas within the study area were classified as moderate, high, or very high fuel hazard based on their potential for wildfires. Approximately half (53 percent) of the study area is classified as a moderate fuel hazard, 32 percent is classified as a high fuel hazard, and 15 percent is classified as a very high fuel hazard.

PUBLIC SAFETY ACTION CONSIDERATIONS

The following public safety considerations were identified for consideration during relicensing:

- Could facilitate coordination of incident and accident reporting to allow for a more comprehensive and timely analysis of safety-related accidents and incidents.
- Could increase the frequency of land-based DFG patrols. These patrols should concentrate on the Afterbay Outlet area, especially during the fishing season.
- Could provide additional warning buoys and/or signs identifying potentially shallow boating areas at Thermalito Afterbay.
- Could expand current visitor safety and management (Interpretation and Education) programs to help reduce safety-related incidents.
- Could develop a fire evacuation plan for recreational users in the OWA.

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ACRONYMS AND ABBREVIATIONS

ACC	Area Control Center
af	acre-feet
BIC	Boat-in Campground
BLM	U.S. Bureau of Land Management
BR	Boat Ramp
CDF	California Department of Forestry and Fire Protection
cfs	cubic feet per second
CHP	California Highway Patrol
DBW	California Department of Boating and Waterways
DFG	California Department of Fish and Game
DPR	California Department of Parks and Recreation
DUA	Day Use Area
DWR	California Department of Water Resources
FERC	Federal Energy Regulatory Commission
FRRPD	Feather River Recreation and Park District
FRSA	Feather River Service Area
GIS	geographic information system
ISO	Independent System Operator
LOSRA	Lake Oroville State Recreation Area
maf	million acre-feet
mph	miles per hour
msl	mean sea level
MW	Megawatt
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
O&M	Operations and Maintenance
OWA	Oroville Wildlife Area
PFD	personal floatation device
PWC	personal watercraft
RM	River Mile
SBF	State Board of Forestry and Fire Protection
SR	State Route
SWP	State Water Project
USACE	U.S. Army Corps of Engineers
USFS	U.S. Department of Agriculture, Forest Service

1.0 INTRODUCTION

This document presents the results of the Recreation Safety Assessment (R-2), one of several recreation studies conducted for the Oroville Facilities (Federal Energy Regulatory Commission [FERC] Project No. 2100) relicensing. This study presents a quantitative and qualitative assessment of recreation public safety within the study area and the study authors develop and present proposed recommendations to be considered during the relicensing process. In developing these proposed recommendations, this study investigates and analyzes recreation public safety issues, incidents, and trends at recreation facilities and use areas in the study area of the Oroville Facilities.

This report is divided into seven sections. The first section is an introduction that provides background information about the Oroville Facilities and information about the agencies responsible for public safety. The second section (2.0 Need for Study) addresses why the study is necessary to complete the relicensing. The third section (3.0 Study Objective) addresses the purpose of the study. The fourth section (4.0 Methodology) discusses how the data and information used in this study were obtained. The fifth section (5.0 Study Results and Analysis) incorporates the results of this study. The sixth section (6.0 Proposed Public Safety Considerations) lists proposed public safety actions to be considered during relicensing to enhance recreation safety in the study area. The final section (7.0 References) lists the sources used to complete this study.

1.1 BACKGROUND INFORMATION

The California Department of Water Resources (DWR) commissioned this study, based on extensive stakeholder input, as part of the collaborative relicensing process for the preparation of a license application to be submitted to the FERC for the Oroville Facilities. As part of this relicensing process, a series of related studies are being conducted to assess and evaluate recreation resources associated with the Oroville Facilities. This report presents the results of one of those studies: an evaluation of recreation safety in the study area including Lake Oroville State Recreation Area (LOSRA), Oroville Wildlife Area (OWA), and other areas with a nexus to the study area.

Lake Oroville is the second largest reservoir in California, after Shasta Lake. Existing facilities at Lake Oroville offer a wide variety of recreational opportunities. These include numerous facilities for visitors to boat, fish, and camp. Opportunities to camp in the area range from fully developed campgrounds to semi-primitive, less-developed sites. Boat-in and floating campsites also exist. There are two full-service marinas, six boat launches, eight car-top boat launches, ten floating campsites, seven floating toilets, and a visitor center located around Lake Oroville. There are major developed recreation facilities at Loafer Creek, Bidwell Canyon, Spillway, and Lime Saddle. Other recreation opportunities include picnicking, swimming, horseback riding, hiking, off-road

bicycle riding, personal watercraft (PWC) use, wildlife watching, and hunting. The area also offers visitor information sites with cultural and informational displays about Project facilities and the area's natural and cultural environment. Additional recreational and visitor facilities are located at Thermalito Forebay, Thermalito Diversion Pool, Thermalito Afterbay, and the OWA.

1.2 STUDY AREA

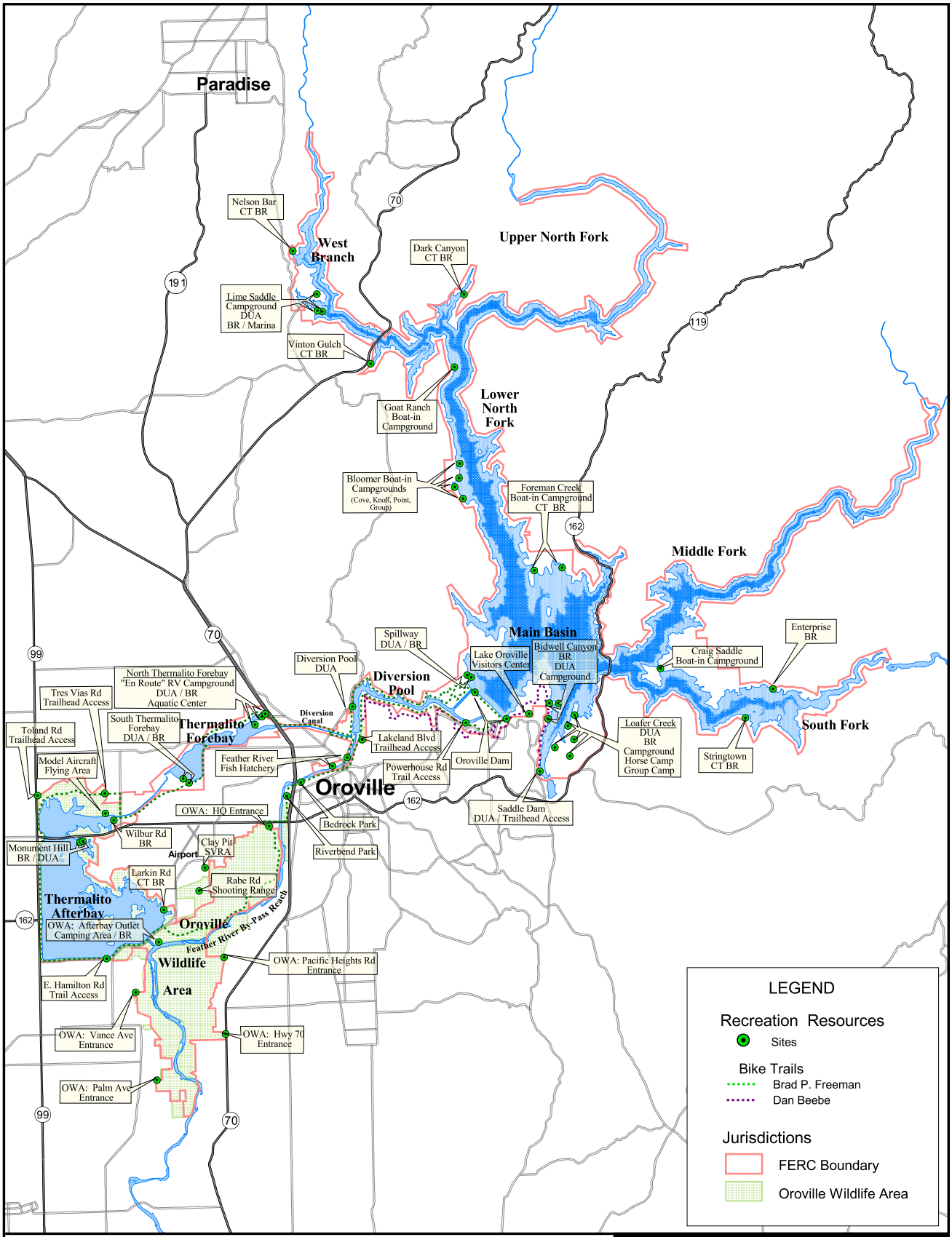
The study area includes all lands and waters within ¼-mile of the FERC Project boundary, which extends from south of the City of Oroville to reaches of the South Fork, Middle Fork, and North Fork of the Feather River (Figure 1.2-1). Within the study area are Lake Oroville, Thermalito Forebay, Thermalito Afterbay, Thermalito Diversion Pool, and the OWA. Lake Oroville and the Thermalito Forebay are within the LOSRA which is managed by California Department of Parks and Recreation (DPR). Project facilities such as the Oroville Dam, Hyatt Powerplant, Thermalito Diversion Dam and Powerplant, Thermalito Power Canal, and the Thermalito Pumping-Generating Plant, are excluded from this analysis as the public is not generally allowed to visit these types of Project facilities. Existing public-developed recreation sites are included in Figure 1.2-1.

1.3 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in Northern California, the San Francisco Bay area, the San Joaquin Valley, and Southern California. The Oroville Facilities are also operated for flood control, power generation, improving water quality in the Delta, enhancing fish and wildlife, and providing recreation.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, OWA, Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, transmission lines, and a relatively large number of recreational facilities. An overview of these facilities is provided in Figure 1.3-1. Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-foot (maf) capacity storage reservoir with a surface area of 15,810 acres at its maximum normal operating level of 900 feet above mean sea level (msl).

FIGURE 1.2-1.



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 Miles

Scale 1 : 142,560
1" = 2.25 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities Relicensing
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Figure 1.2-1
(R-2)

PROJECT AREA AND
ASSOCIATED RECREATION SITES

Prepared by: PJ -- EDAW, Inc. Date 1/15/04 P:\2000\0s016.gis\arcview\apr\rec_acc.apr

BACK OF FIGURE 1.2-1.

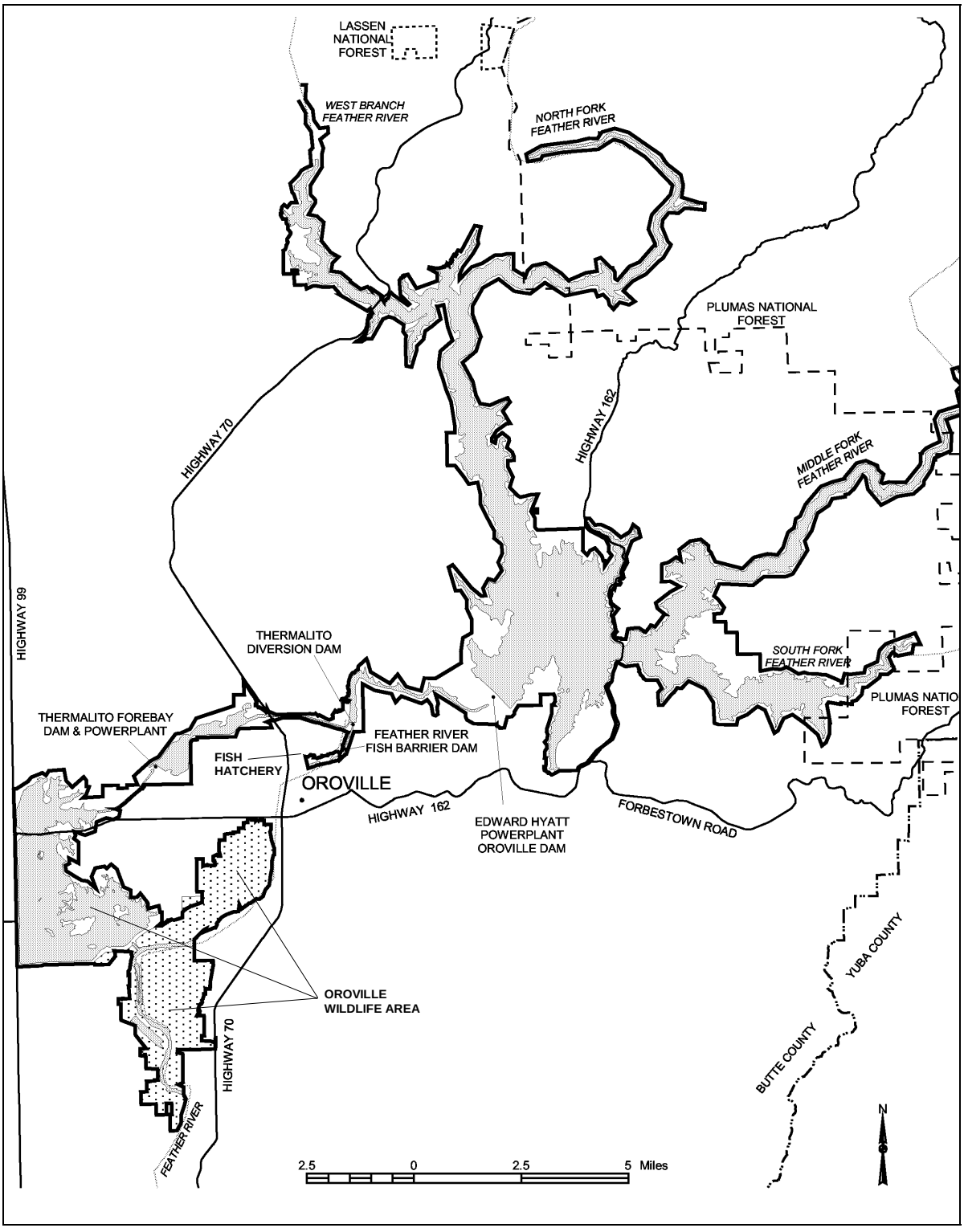


Figure 1.3-1. Oroville Facilities and the FERC Project Boundary.

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground powerplant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cubic feet per second (cfs) and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, 4 miles downstream of the Oroville Dam, creates a tailwater pool for the Hyatt Pumping-Generating Plant and is used to divert water into the Thermalito Power Canal. Thermalito Diversion Dam Power Plant is a 3-MW powerplant located on the left abutment of the Diversion Dam. The powerplant releases a maximum of 615 cfs of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, provides recreational opportunities, and provides local irrigation water. Several local irrigation districts also receive Lake Oroville water via the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery is an anadromous fish hatchery intended to compensate for salmon and steelhead spawning grounds made unreachable by construction of Oroville Dam. Hatchery facilities have a production capacity of 10 million fall-run salmon, 5 million spring-run salmon, and 450,000 steelhead annually (pers. comm., Anna Kastner, 2003). However, diseases have reduced hatchery production in recent years.

The OWA comprises approximately 11,000 acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area is adjacent to or straddles 12 miles of the Feather River, and includes willow and cottonwood-lined ponds, islands, and channels.

Recreation areas in the OWA include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill Day Use Area (DUA), model airplane grounds, three boat launches on the Afterbay and two on the river, and two primitive camping areas. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a few locations.

1.4 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly, and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, diversion, and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for Project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, instream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multi-year carryover storage. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit drawdown of the reservoir below that level. If hydrology is drier or requirements greater than expected, additional water could be released from Lake Oroville. The operations plan is updated regularly to reflect forecast changes in hydrology and downstream operations. Typically, Lake Oroville is filled near its maximum operating level of 900 feet above msl in June and then lowered as necessary to meet downstream requirements, to a minimum level in December or January (occasionally below 700' msl). During drier years, the reservoir may be drawn down more and may not fill to desired levels the following spring. Project operations are directly constrained by downstream operational demands and flood management criteria as described below.

1.4.1 Downstream Operation

An August 1983 agreement between DWR and DFG, entitled "Agreement Concerning the Operation of the Oroville Division of the SWP for Management of Fish & Wildlife," sets criteria and objectives for flow and temperatures in the low-flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona, which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period (except for flood management, failures, etc.); (3) requires flow stability during the peak of the fall-run Chinook salmon spawning

season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.4.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the Diversion Dam outlet, Diversion Dam powerplant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become de-watered.

1.4.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery temperature objectives are 52\°F for September, 51\°F for October and November, 55\°F for December through March, 51\°F for April through May 15, 55\°F for last half of May, 56\°F for June 1-15, 60\°F for June 16 through August 15, and 58\°F for August 16-31. In April through November, a temperature range of plus or minus 4\°F is allowed for objectives.

There are several temperature objectives for the Feather River downstream of the Afterbay outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook salmon. From May through August, the temperatures must be suitable for shad, striped bass, and other warmwater fish.

The National Oceanic and Atmospheric Administration NOAA) Fisheries (formerly the National Marine Fisheries Service [NMFS]) has also established an explicit criterion for steelhead trout and spring-run Chinook salmon, included in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead. As a reasonable and prudent measure, DWR attempts to control water temperature at Feather River Mile (RM) 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure attempts to maintain water temperatures less than or equal to 65\°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist

the State of California with supplying energy during periods when the California Independent System Operator (ISO) anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., minimum 65\°F from approximately April through mid-May, and minimum 59\°F during the remainder of the growing season), though there is no explicit obligation for DWR to meet the rice water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

1.4.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 af (e.g., in July 2002) are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River (and outside of the FERC Project boundary) continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay and stored until it is pumped into the California Aqueduct.

1.4.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest reasonable water quality, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.4.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are an example of multiple use of reservoir space. When flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), required flood management space is at its greatest to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

1.5 AGENCIES RESPONSIBLE FOR PUBLIC SAFETY IN THE STUDY AREA

Several federal, State, and local agencies and services have public safety responsibilities in the study area. It is important to determine which agency is responsible for certain areas within the study area so that recreation-related safety issues and concerns can be appropriately addressed. This information also provides a good background for the reader. Brief discussions of each agency's responsibilities are included below.

1.5.1 Federal Energy Regulatory Commission (FERC)

FERC is the major federal regulatory agency responsible for regulating hydroelectric dams. As a part of relicensing, FERC requires that dam safety be addressed. Also, the Division of Dam Safety and Inspections (a division of FERC) is responsible for making sure that licensed dams are constructed, operated, and maintained to protect life, health, and property. Prelicense, periodic, and special site inspections are conducted during construction, and periodic inspections during project operation are performed every 1 to 3 years.

1.5.2 United States Forest Service (USFS)

The U.S. Forest Service (USFS) is a federal resource agency within the Department of Agriculture; they are responsible for managing over 190 million acres in the United States. The USFS, Plumas National Forest, manages parcels of land in the eastern portion of the study area. They have no formalized patrols in the study area, but do respond to calls for mutual support.

1.5.3 U.S. Bureau of Land Management (BLM)

The Bureau of Land Management (BLM) is a federal resource agency within the Department of the Interior and is responsible for managing 261 million acres, primarily in the western United States. BLM has lands within the study area administered by the Redding Field Office; there is interest in transferring these lands to the State of California. BLM collaborates with State agencies (DPR, DWR) and allows them to patrol BLM-managed lands within the study area.

1.5.4 California Department of Parks and Recreation (DPR)

The DPR is a major provider of recreation opportunities in the State. DPR manages about 270 park units in California including historic and cultural sites as well as natural areas. Although DPR owns very little land in the vicinity of Lake Oroville (the land is primarily owned by DWR), they are responsible for managing and patrolling recreation sites in LOSRA including Lake Oroville and Thermalito Forebay. DPR conducts boat patrols at Lake Oroville and Thermalito Forebay as well. Boat patrols take place on the weekends during peak and shoulder seasons, and sporadically during the weekdays during these time periods. Currently, there are eleven rangers and two supervising rangers at LOSRA, but DPR is currently undergoing a restructuring and these totals may change (pers. comm., Steve Feazel, 2003).

1.5.5 California Department of Fish and Game (DFG)

DFG is the primary State agency responsible for the management of fish and wildlife in California. DFG is responsible for law enforcement within the OWA, which includes the Thermalito Afterbay. DFG wardens patrol the OWA along the Feather River, while contracted Butte County Sheriff's Office deputies patrol the Thermalito Afterbay. There is one DFG game warden to patrol DFG–managed lands in Butte County.

1.5.6 California Department of Water Resources (DWR)

The DWR is responsible for managing water resources in California in cooperation with other federal, State, and local agencies. DWR owns much of the land related to the Oroville Facilities, yet has limited patrol duties in relation to recreation areas. Contracted security officers patrol DWR facilities and buildings, as well as land-based recreation sites at the Thermalito Afterbay. DWR also operates an Area Control Center (ACC) near the Oroville Dam that coordinates operations and generation activities related to the Project. The Center operates 24 hours a day and coordinates patrols and security at the field level.

1.5.7 California Highway Patrol (CHP)

The mission of the California Highway Patrol (CHP) is to ensure safety and provide service to the public, especially related to the State and federal highway transportation system. They also assist local government during emergencies when requested. Two State-managed highways, State Route (SR) 70 and SR162, are in the proximity of the Oroville Facilities, and many recreational users in the area use these two highways to reach recreation facilities. The CHP is also responsible for patrolling some State-managed lands such as the Oroville Dam and powerhouse. CHP often responds to traffic incidents on roads within and adjacent to the study area. They also provide back-up for other agencies responsible for public safety in the study area.

1.5.8 California Department of Boating and Waterways (DBW)

The California Department of Boating and Waterways (DBW) operates a number of watercraft-related programs, including boating and aquatic safety education and training programs, boat and yacht licensing programs, and programs that fund the development of public access boating facility projects. DBW does not have patrol responsibilities within the study area, but they are involved with boating safety throughout the State and provide funding to others including the Butte County Sheriff's Office. DBW is also responsible for maintaining Statewide boating accident statistics.

1.5.9 California Department of Forestry and Fire Protection (CDF)

The California Department of Forestry and Fire Protection (CDF) has a mission to protect the people of California from fires, respond to emergencies, and protect and enhance forest, range, and watershed values providing social, economic, and environmental benefits to rural and urban citizens. They have major fire-related responsibilities within the study area, including fire fighting and prescribed burning. They are also often first responders to accidents in the study area and provide assistance and mutual aid on search and rescue operations.

1.5.10 Butte County Sheriff's Office

The Butte County Sheriff's Office is responsible for patrolling unincorporated areas in Butte County; there are over 90,000 people living in these areas. The Butte County Sheriff's Office is also responsible for patrolling the waters of Thermalito Afterbay, and river reaches within Butte County under contract with DBW. There are also lands adjacent to Project facilities that fall under their jurisdiction.

1.5.11 Oroville Police Department

The City of Oroville Police Department is responsible for public safety within the city limits of Oroville. The Oroville Police Department has 25 full-time officers. The

Department has law enforcement jurisdiction along the Feather River between the Diversion Pool and the OWA. They perform patrol duties on lands adjacent to Project facilities. These patrols often involve issuing citations for vehicle mechanical violations, problems with vehicle trailers, or alcohol use. The Department also provides mutual aid support during incidents at Project facilities.

1.5.12 Feather River Recreation and Park District (FRRPD)

The Feather River Recreation and Park District (FRRPD) serves 50,000 residents in southwestern Butte County, operating as a special district. The district serves as a major provider of recreation programs and park management in the greater Oroville area. The most notable park site in the vicinity of the study area is Riverbend Park, operated in collaboration with DFG and the Wildlife Conservation Board. FRRPD does not have law enforcement staff; they plan for safety of their facilities on a regular operational basis, but law enforcement is typically provided by the Oroville Police Department, Butte County Sheriffs Office, and/or DFG.

2.0 NEED FOR THIS STUDY

This study is needed because FERC regulations require that licensees develop a comprehensive recreation plan during the relicensing process. The plan should address significant safety issues and concerns that were identified during relicensing. Recreation is an important part of the Oroville Facilities, as the area receives significant recreation use and the resultant safety issues need to be addressed along with other major issues. Many of the activities that are popular at the Oroville Facilities by their nature have potential significant safety issues. Also, hydropower facilities typically have features including spillways and intakes that may pose potential hazards to recreational users.

Appropriate safety measures will be considered for incorporation into the development and operations and maintenance (O&M) programs of the new recreation plan. This study addresses Issue Statement R2—adequacy of public safety at the Project recreation facilities.

3.0 STUDY OBJECTIVE

The objective of this study is to identify public recreation safety issues and concerns within the study area and propose recommendations to address these safety issues and concerns over the term of the new license. This study assesses current and historic recreation-related safety incidents and trends, as well as recreation safety-related management policies, procedures, and facilities and equipment. Recreation safety is important to all visitors, recreation providers, and managers within the study area.

4.0 METHODOLOGY

At the outset of the study, a review of a FERC publication was conducted to assist in identifying potential recreation safety issues in the study area. The Division of Dam Safety and Inspections (a division of FERC) cited potentially hazardous features related to recreation and public use at dams in a 1992 publication, *Guidelines for Public Safety at Hydropower Projects* (FERC 1992). Along with the input of the Recreation and Socioeconomics Work Group, the article provided insight as to where special attention could be focused while collecting and analyzing data.

The following features were identified in the *Guidelines* as potentially hazardous features, and all may have implications related to recreation safety:

- Spillways
- Powerhouse intakes
- Powerhouse tailrace areas
- Spillway tailraces
- Canals
- Intake areas
- Boat ramps
- Natural channels
- Substations and powerlines
- Bridges (in particular, low bridges)
- Project structures
- Natural and other hazards (submerged stumps, protruding rock structures, submerged structures)
- Recreation areas
- Winter conditions (icy conditions)

A variety of methods were used to analyze and document potential recreation safety issues and concerns to develop proposed recommendations. Once this information was compiled and analyzed, proposed recommendations were developed.

The following methods were used to complete this study, and a discussion of each method is included below:

- Interviews with safety-related personnel;
- Review of recreation surveys and safety issues;
- Review of incident reports / accident statistics;
- Field observation of potential hazards;
- Cell phone coverage / radio communications; and
- Wildland fire safety.

4.1 INTERVIEWS WITH SAFETY-RELATED PERSONNEL

To identify issues related to recreation safety in the study area, representatives of agencies responsible for recreation safety in the study area were interviewed. The goal of the interviews was to identify issues related to recreation safety from the point of view of law enforcement and land and resource managers. Representatives familiar with enforcement issues were interviewed from the following responsible agencies: USFS, BLM, DPR, DFG, DWR, Butte County Sheriffs Office, the Oroville Police Department, and First Responder (local ambulance service). Responses to these interviews were incorporated into the results of this study. These managers and law enforcement officers have a unique insight into recreation safety and related issues. CHP referred the authors to DWR staff to discuss safety-related issues.

Interview questions asked were related to the following potential safety topics related to recreation:

- Boating safety issues and law enforcement problems;
- Health and injury issues;
- Wildland fire safety;
- Response times;
- Other potential issues; and
- Public safety action suggestions.

4.2 REVIEW OF RECREATION SURVEYS AND SAFETY ISSUES

Study R-13 (Recreation Surveys) provided information on user perceptions of safety within the study area and helped identify additional issues related to recreation safety. This study includes input from surveys distributed between June 2002 and May 2003.

The Recreation Surveys were distributed at developed and dispersed recreation sites throughout the study area. Several different surveys were used to reach a variety of user groups and to reach users that were more difficult to intercept (such as those launching their boat). An on-site survey was used when directly contacting people, while a windshield survey was used when face-to-face contact was not possible or the contact took place at an awkward moment. A mail-back survey was used to obtain information that was not time-dependent, such as general impressions of the recreation area. Survey data collection (SP R-14, Assess Regional Recreation and Barriers to Recreation) also took place at three other reservoirs in Northern California (Lake Berryessa, Black Butte Reservoir, and Shasta Lake) to identify region-wide issues as well as determine issues that may apply only to the Oroville Facilities study area.

Recreation surveys elicit information on visitors' impression of encountering at-risk experiences and conditions while visiting Oroville Facilities, as well as any

other general comments about their trip. The following topics related to safety were addressed in the surveys:

- Types and location of at-risk encounters on the water;
- Water level and boating safety;
- Knowledge and satisfaction with hunting and fishing regulations;
- At-risk encounters on trails;
- Types of at-risk encounters on the water at similar sites; and
- Response times.

The results of the surveys were analyzed to determine what, if any, recreation safety issues and concerns may need to be addressed. For additional information regarding the recreation survey methodology and study results, see Study R-13 (Recreation Surveys).

4.3 REVIEW OF INCIDENT REPORTS / ACCIDENT STATISTICS

Incident reports and summaries were acquired from DWR and were subsequently categorized and analyzed. The reports cover a wide range of incidents and are available from 1995 through 2002. A summary of incidents at LOSRA in 2002 was provided by DPR; DPR also provided information on the location of boating accidents on Lake Oroville. These data were analyzed to identify trends and significant safety issues, if any.

Boating accident statistics were acquired from DBW. Boating accidents are reported to DBW if there was a fatality, or an injury that requires medical attention beyond first aid, or property damage greater than $500. It is important to note that not all accidents are reported due to a variety of reasons. Data were also obtained from the *2001* and *2002 California Boating Safety Reports* (DBW 2002, 2003a). These reports were reviewed and provided insight into Statewide boating issues.

4.4 FIELD OBSERVATIONS OF POTENTIAL HAZARDS

The Recreation Safety Assessment was primarily a desktop study (per the R-2 Study Plan), but some fieldwork was done to complete this study. In coordination with other studies, safety hazards were evaluated throughout the study area, including rock outcroppings, stumps, and debris. Because of significant recurring issues raised, the Afterbay Outlet area was specifically observed during the fishing season to evaluate potential safety issues.

4.5 CELL PHONE COVERAGE / RADIO COMMUNICATIONS

To help determine areas within the study area that may have potential gaps in communication coverage where visitors could not call out for assistance, study area recreation sites and areas were visited. Two personal cellular phone

providers' (Verizon and Sprint) coverages were tested at recreation areas and on Lake Oroville. Radios used by DPR and DWR staff were also tested. Additional input regarding specific areas with potential phone or radio coverage issues was also provided by DPR operations staff. Some sites were tested more than once as atmospheric conditions may affect radio and cellular coverage. Areas where coverage is poor were noted.

4.6 WILDLAND FIRE SAFETY

Wildland fire was addressed in this study as recreation can both cause and be affected by wildland fire and thus it can have an impact on safety. This study component was conducted in coordination with studies coordinated by the Land Use, Land Management, and Aesthetics Work Group, in particular, L-5 (Fuel Load Management Evaluation). This study entailed a review of Statewide and study area publications and maps related to wildland fire. Information was obtained from interviews with safety-related personnel (see Section 4.1). In addition, information about local fire history and response times to recreation sites and areas was obtained from the CDF.

5.0 STUDY RESULTS AND ANALYSIS

This section discusses the results of the study. This section is divided into the following subsections:

- Section 5.1 - Interviews with Safety-Related Personnel
- Section 5.2 - Review of Recreation Surveys and Safety Issues
- Section 5.3 - Review of Incident Reports / Accident Statistics
- Section 5.4 – Field Observations of Potential Hazards
- Section 5.5 - Cell Phone Coverage / Radio Communications
- Section 5.6 - Wildland Fire Safety

5.1 INTERVIEWS WITH SAFETY-RELATED PERSONNEL

Representatives of agencies and services responsible for recreation safety in the study area were interviewed. The goal of the interviews was to identify issues related to recreation safety from the point of view of law enforcement and land and resource managers. Representatives from the following responsible agencies and services were interviewed: USFS, BLM, DWR, DPR, DFG, Butte County Sheriff's Office, Oroville Police Department, and First Responder (the local ambulance service). CHP declined the interview and referred the authors to DWR staff to address safety-related questions.

5.1.1 Boating Safety Issues and Law Enforcement Issues to Consider

The following issues were identified as being recreational boating law enforcement issues, based on interviews with agency representatives. Many of the issues are consistent with Statewide boating safety issues that were identified in California Boating Safety Reports (DBW 2002, 2003a). The following safety-related issues were identified by one or more interviewees:

- Boaters often exceeding the 5 miles per hour (mph) limit in designated zones
- PWC users jumping wakes and following other boats too closely
- Alcohol use while boating
- Perceived shortage of enforcement officers
- Boaters not wearing personal floatation devices (PFDs)
- Aquatic plants getting caught in the jets of PWC or jet boats
- Daily water fluctuations at Thermalito Afterbay
- Seasonal water level changes at Lake Oroville

Daily water fluctuations at Thermalito Afterbay were noted both by the Butte County Sheriff's Office and DFG. There have been boating accidents in areas that are several feet deep one day, and several inches deep the next. It was noted that property damage has occurred (such as motors being damaged), and

the fluctuation is a potential hazard to both motorized and non-motorized watercraft (e.g., sailboats and sailboards).

5.1.2 Health and Injury Issues to Consider

The following issues were identified by agency representatives as being health and injury issues within the study area:

- There have been numerous reported fights, knifings, and shootings at the Afterbay Outlet fishing area. These issues are most serious during the salmon fishing season. These issues were identified by representatives from DFG, DWR and Oroville Police Department.
- Hypothermia was identified as an occasional issue among swimmers and anglers along the Feather River below the Oroville Dam.
- Major health care providers in the area include Oroville Hospital in Oroville and Enloe Hospital in Chico. Oroville Hospital has 130 physicians and a 24-hour emergency room. It is the base hospital for all ambulance service in southern Butte County. Enloe Hospital in Chico is the largest hospital in the county and provides helicopter evacuation services for areas within 60 miles of Chico.
- The primary ambulance service is First Responder, and the response time is generally in the 15-minute range for the majority of the developed recreation sites. However, first response is often provided by a variety of agencies including Oroville Police Department, Butte County Sheriff's Office, Butte County Fire, DPR, CDF, and CHP. Local helicopter evacuation (Enloe FlightCare) is provided through Enloe Hospital in Chico; once contacted, response time is about 10 minutes to the Project area.

5.1.3 Wildland Fire Safety Issues to Consider

The following statements and observations were made by area land managers regarding wildland fire in the study area:

- Fires have occurred frequently in the OWA, and fire-weakened trees can create a hazard for hunters and hikers in the area.
- There is no evacuation plan for the OWA in case of a potentially devastating wildfire.

5.1.4 Other Issues to Consider

The following issues were also mentioned by agency representatives:

- Traditionally, DFG does not manage developed recreation, yet areas within the OWA receive heavy use comparable to developed recreation sites.

- Illegal dumping occurs within the study area, including cars and appliances and items associated with methamphetamine labs.

5.1.5 Public Safety Action Considerations Suggestions

Agency representatives were asked to provide ideas about potential public safety action considerations. The following suggestions were made:

- Increase the frequency of patrols and number of staff at the OWA (law enforcement, recreation, habitat, maintenance);
- Develop recreation sites (provide facilities) at OWA where appropriate;
- Increase the frequency of patrols / security at Project parking lots and the fish hatchery;
- Increase the frequency of patrols to deal with alcohol-related nuisances; and
- Develop and implement additional educational programs regarding boating and swimming safety.

5.2 SAFETY-RELATED RESULTS FROM THE RECREATION SURVEY

Recreation surveys included questions related to recreation safety within the study area and at similar sites in Northern California. For additional information about these surveys and their full results, see Study R-13 (Recreation Surveys), Study R-7 (Reservoir Boating Study), and Study R-14 (Assess Regional Recreation and Barriers to Recreation). The results presented in this report include surveys distributed between June 2002 and May 2003. These review of recreation survey results provided valuable insight into the user experience with recreation safety in the study area.

With respect to safety issues, the survey results were subdivided into three sections:

- Boating safety
- Hunting and fishing safety
- Trail safety

5.2.1 Boating Safety Survey Responses

Survey respondents who were boating in the study area were asked if they experienced any encounters that may have put themselves or others at potential risk (Table 5.2-1). Slightly less than 10 percent of the respondents stated that they had been put at-risk by others while boating. About 14 percent of respondents stated that they experienced boating situations that put others at potential risk.

Table 5.2-1. Potential at-risk encounters on the water.

Survey Question	Yes	No
Did you experience any encounters on the water that put you at risk? (N = 1,143)	9.6% (114)	90.4% (1,069)
Did you experience any encounters on the water that put others at risk? (N = 1,183)	13.6% (155)	86.4% (988)

Source: EDAW (2003)

The 114 boating respondents that stated that they did encounter situations on the water that may have put them at-risk were asked to describe the encounter. The survey responses were categorized and are listed in Table 5.2-2. Encounters with PWC users were cited by 25 respondents (out of 114 total respondents) who stated that they encountered a situation that put them at-risk. These results indicate that there is some ongoing on-water conflict with PWC users as several boaters had an encounter that they perceived as putting them at-risk. Also, 24 respondents cited other boats being too close to their boat as an encounter that put them at risk. In addition, 23 respondents noted that problems regarding rights-of-way or blind corners may have put them at risk.

Table 5.2-2. Type of encounter on the water that may put respondents at risk.

Type of Encounter (self at risk)	Number of Encounters	Percentage of Total (n=114)
PWC use	25	21.9%
Boats too close	24	21.1%
Problems with right-of-way / blind corners	23	20.2%
Alcohol use/Larceny/Mischievous or dangerous behavior	11	9.6%
Too fast / boaters not following speed regulations	10	8.8%
Problems at boat ramp	8	7.0%

Note: For those responding "yes" to the first question reported in Table 5.2-1.
Source: EDAW (2003)

Surveyed boaters that experienced behavior on the water that likely put others at risk were also asked to describe their experiences (Table 5.2-3). Encounters with PWC users, problems with right-of-ways, and watercraft moving too fast were the most common responses among those who stated that they experienced an encounter that put others at risk.

Table 5.2-3. Type of encounter on the water that may put others at risk.

Type of Encounter (others at risk)	Number of Encounters	Percentage of Total (n=155)
PWC use	28	18.1%
Problems with right-of-way / blind corners	27	17.4%
Too fast / boaters not following speed regulations	23	14.8%
Alcohol Use / Mischievous or dangerous behavior	20	12.9%
Boats too close	16	10.3%
At Boat ramp activity	9	5.8%

Note: For those responding "yes" to the second question reported in Table 5.2-1.
Source: EDAW (2003)

Survey respondents that stated that they experienced an encounter that put them at risk were asked to identify where they had experienced this encounter. Table 5.2-4 shows that the Main Basin of Lake Oroville, followed by the Thermalito Afterbay and the South and Middle Forks of Lake Oroville, were listed as the most common locations for at-risk encounters to occur. It is important to note that 7 boaters stated their at-risk encounter was near a dock or boat ramp, but did not provide the geographic location of the encounter. The survey results indicate that at-risk encounters take place throughout the study area; however, the main basin of Lake Oroville had the most at-risk encounters. Certain areas within the study area appear have more frequent troublesome behavior, including the OWA and the Thermalito Afterbay.

Table 5.2-4. Location of at-risk encounters.

Location of Experience That Put You At-Risk	Number of Responses
Lake Oroville	
Main Basin	13
South Fork	9
Middle Fork	6
West Branch	5
Lower North Fork	5
Upper North Fork	3
Downstream Areas	
Thermalito Afterbay	12
OWA (Includes Feather River below SR 162)	5
Thermalito Forebay	1
Feather River (Diversion Pool to SR 162)	1
Diversion Pool	0

Source: EDAW (2003)

To compare recreation safety in the study area with other reservoirs in Northern California, visitors at Shasta Lake, Black Butte Reservoir, and Lake Berryessa were asked if they had experienced any encounters on the water that put them or others at-risk (Table 5.2-5). In both cases, a similarly low percentage of the respondents stated that they had (7.2 percent and 10.2 percent, respectively). These results are similar to the results in Table 5.2-1 that summarizes the responses of surveyed Lake Oroville recreationists, and indicate that visitors perceive about the same amount of at-risk experiences in the study area as they do at similar reservoirs in Northern California.

Table 5.2-5. At-risk encounters on the water at similar sites*.

Survey Question*	Yes	No
Did you experience any encounters on the water that put you at risk? (N = 293)	7.2% (21)	92.8% (272)
Did you experience any encounters on the water that put others at risk? (N = 293)	10.2% (30)	89.8% (263)

**Shasta Lake, Lake Berryessa, and Black Butte Lake*
Source: EDAW (2003.)

Respondents to the similar-site survey were asked to identify what type of encounter put them at-risk (Table 5.2-6). Results in Table 5.2-6 include the

results of follow-up questions to those shown in Table 5.2-5. Encounters with PWC users were overwhelmingly the most common, although several respondents were concerned about other boats being too close. In general, the concerns of similar-site visitors are the same as visitors to Lake Oroville, but at-risk experiences with PWC users appear to be modestly more common at the other lakes and reservoirs.

Table 5.2-6. Type of encounter on the water that put users at risk at similar sites.*

Type of Encounter	Number of Encounters	Percentage of Total
Personal watercraft users	24	47.1%
Boats too close	9	17.6%
Too fast / boaters not following speed regulations	6	11.8%

**Shasta Lake, Lake Berryessa, and Black Butte Lake*
Note: For those responding "yes" to both questions presented in Table 5.2-5.
Source: EDAW (2003)

To address the potential concerns of boaters who use the Project waterbodies, respondents were asked if they were more concerned about safety when they were boating at lower pool levels (Table 5.2-7). Almost three-quarters of the respondents (71.4 percent) stated that they were more concerned about safety, while less than one-third (28.6 percent) stated that they were not more concerned. Potentially, this general concern may be due to the smaller surface area available for boating, additional shallow areas to be aware of, or additional objects that were previously submerged at higher pool levels.

Table 5.2-7. Boater safety concern with lower reservoir pool levels (at Oroville Facilities).

Survey Question	Yes	No
Were you more concerned about the safety of boating when the water was lower? (N=70)	71.4% (50)	28.6% (20)

Source: EDAW (2003)

5.2.2 Hunting and Fishing Safety

A hunter-oriented survey asked users if they were knowledgeable about hunting regulations within the study area and if the regulations allowed for a quality experience (Table 5.2-8). Of 103 responses, 91 people (88.3 percent) stated that they were knowledgeable about existing regulations. There were 12 individuals (11.7 percent) that stated that they were not knowledgeable about area hunting regulations. The most common explanation for this (5 responses) stated that the regulations or specific information were not readily available.

The vast majority of hunters surveyed (84.2 percent) believe that the hunting regulations allow for a quality experience, while 15.8 percent of the respondents believe that the regulations do not allow for a quality experience. The most common complaints were that there should be more time to hunt (either more

days or more time during the day), or that there should be more birds and habitat for hunting purposes.

Table 5.2-8. Hunting regulations and safety.

Survey Question	Yes	No
Do hunters feel knowledgeable about study area hunting regulations? (N=103)	88.3% (91)	11.7% (12)
Do the hunting regulations allow for a quality experience? (N=101)	84.2% (85)	15.8% (16)
Did you have any encounters, while hunting, that put you at risk? (N=100)	6.0% (6)	94.0% (94)

Source: EDAW (2003)

Hunters were asked if they had experienced any encounters that put them at risk. The vast majority of hunters (94 percent) stated they did not (Table 5.2-8); however, six users (6 percent) stated they did have an encounter that put them at risk. The most common reason for these 6 at-risk encounters was that other hunters were too close, or were in each other's area; issues related to visitor capacity will be furthered addressed in R8 – Carrying Capacity. Overall, the results indicate that most hunters were satisfied with their hunting experiences and safety conditions in the study area.

Survey respondents that went fishing while in the study area were asked if they felt knowledgeable about fishing regulations in the study area. This is important as there had been incidents reported of user-conflict in the vicinity of the Afterbay Outlet, potentially related to a lack of knowledge about local fishing regulations. The majority (87.9 percent) of respondents stated that they were knowledgeable about the regulations (Table 5.2-9).

Table 5.2-9. Knowledge of fishing regulations.

Survey Question	Yes	No
Do anglers feel knowledgeable about fishing regulations? (N=1,058)	87.9% (930)	12.1% (128)

Source: EDAW (2003)

5.2.3 Trail Safety

Survey respondents using study area trails were asked if they had any encounters on the trail that may have potentially put them at risk. Overall, at-risk encounters on study area trails are relatively uncommon (Table 5.2-10). However, a few trail users (6.8 percent) stated that they did experience an at-risk or potential at-risk encounter while on study area trails. Horseback riders had the highest rate of encounters; of the 117 equestrians who answered this question, 15 (12.8%) stated that they had an encounter on the trail that potentially put them at risk.

Table 5.2-10. Potential at-risk trail encounters.

Survey Question	Yes	No
Did you have encounters on the trail with other users that put you at risk? (N = 805; all trail users)	6.8% (55)	93.2% (756)
Hikers (N=545)	5.7% (31)	94.3% (514)
Bicyclists (N=114)	7.9% (9)	92.1% (105)
Equestrians (N=117)	12.8% (15)	87.2% (102)
Other users (N=22)	0	22 (100%)
Multiple types (N=13)	0	13 (100%)

Source: EDAW (2003)

Respondents who stated that they had an encounter on the trail that may have put them at-risk were also asked with whom they had the encounter (multiple responses were accepted). Some of the respondents did not answer this follow-up question. Table 5.2-11 presents the types of encounters that different trail users had that were perceived to put them at-risk. Other types of encounters include a wide variety of responses, such as drinkers on the trail, ATV-users, loud people, etc. Some horseback riders cited encounters with bicyclists as a concern; however, no bicyclists reported having at-risk encounters with any horseback riders.

Table 5.2-11. Type of encounter on trails that put users at risk.

Type of User	Encounter with Hikers	Encounter with Bicyclists	Encounter with Horseback Riders	Other Encounters
Hikers (31 Respondents)	25.8% (8)	6.5% (2)	12.9% (4)	25.8% (8)
Bicyclists (9)	11.1% (1)	0	0	44.4% (4)
Horseback Riders (15)	26.7% (4)	60.0% (9)	33.3% (5)	20.0% (3)
Total (55)	23.6% (13)	20.0% (11)	12.0% (9)	27.3% (15)

Note: For those responding "yes" to the question reported in Table 5.2-10.
Source: EDAW (2003)

5.3 REVIEW OF INCIDENT REPORTS/ACCIDENT STATISTICS

This section reviews and analyzes boating accident statistics and incident reports provided by study area agencies.

5.3.1 Boating-Related Accidents

This subsection discusses boating accident statistics collected by DBW and DPR for Project waterways as well as other waterways in California. Boating accident statistics were not available for the Thermalito Forebay, Feather River, or the Diversion Pool; DBW does not keep accident statistics for these water bodies.

5.3.1.1 Statewide Boating Accidents

DBW analyzed reported boating accidents in California for the previous year and produced the *2001* and *2002 California Boating Safety Reports* (DBW 2002, 2003a). An accident is considered reportable if: a person dies, disappears, or is

injured requiring medical attention beyond first aid; vessel or other property damage exceeds $500; or there is complete loss of a vessel. It is important to note that some accidents that meet these criteria go unreported for a variety of reasons, including lack of awareness about reporting requirements, liability concerns, and non-compliance.

Table 5.3-1 shows reportable accidents, injuries, and fatalities in California during the past 10 years. There were 907 accidents reported during 2001 and 911 accidents in 2002. In 2002, there were 468 injuries, 53 fatalities, and $3.7 million in property damage attributed to these accidents. The 10-year high for reported accidents in California was in 1997 (a high water year) with 925 accidents. The highest number of reported injuries occurred in 1996, with 537. The highest number of fatalities occurred in 1993, with 67. The number of accidents and injuries went up during the mid- to late-1990s, and has since appeared to have leveled off. The only exception was in 1998, which had a relatively low accident and injury total. The number of fatalities appears to be much more randomly distributed. The average number of reported accidents is 849, resulting in an average of 477 injuries and 51 fatalities.

The reports cite that the majority of the accidents occurred between May and September, on weekends and holidays, and between 2:00 and 4:00 p.m. This is not surprising as these times are often the busiest at outdoor recreation areas.

Table 5.3-1. Reported boating-vessel accidents in California (1993-2002).

Year	Number of Reported Accidents	Number of Injuries	Number of Fatalities
1993	743	434	67
1994	739	386	40
1995	833	490	52
1996	850	537	56
1997	925	526	43
1998	772	413	58
1999	907	491	42
2000	906	524	51
2001	907	502	48
2002	911	468	53
Average (1993-2002)	**849**	**477**	**51**

Source: DBW 2002, 2003a

In addition, roughly one-fourth of all accidents occurred during the three summer holiday weekends: Memorial Day, Independence Day, and Labor Day (DBW 2002, 2003a).

5.3.1.2 Lake Oroville Boating-Related Accidents

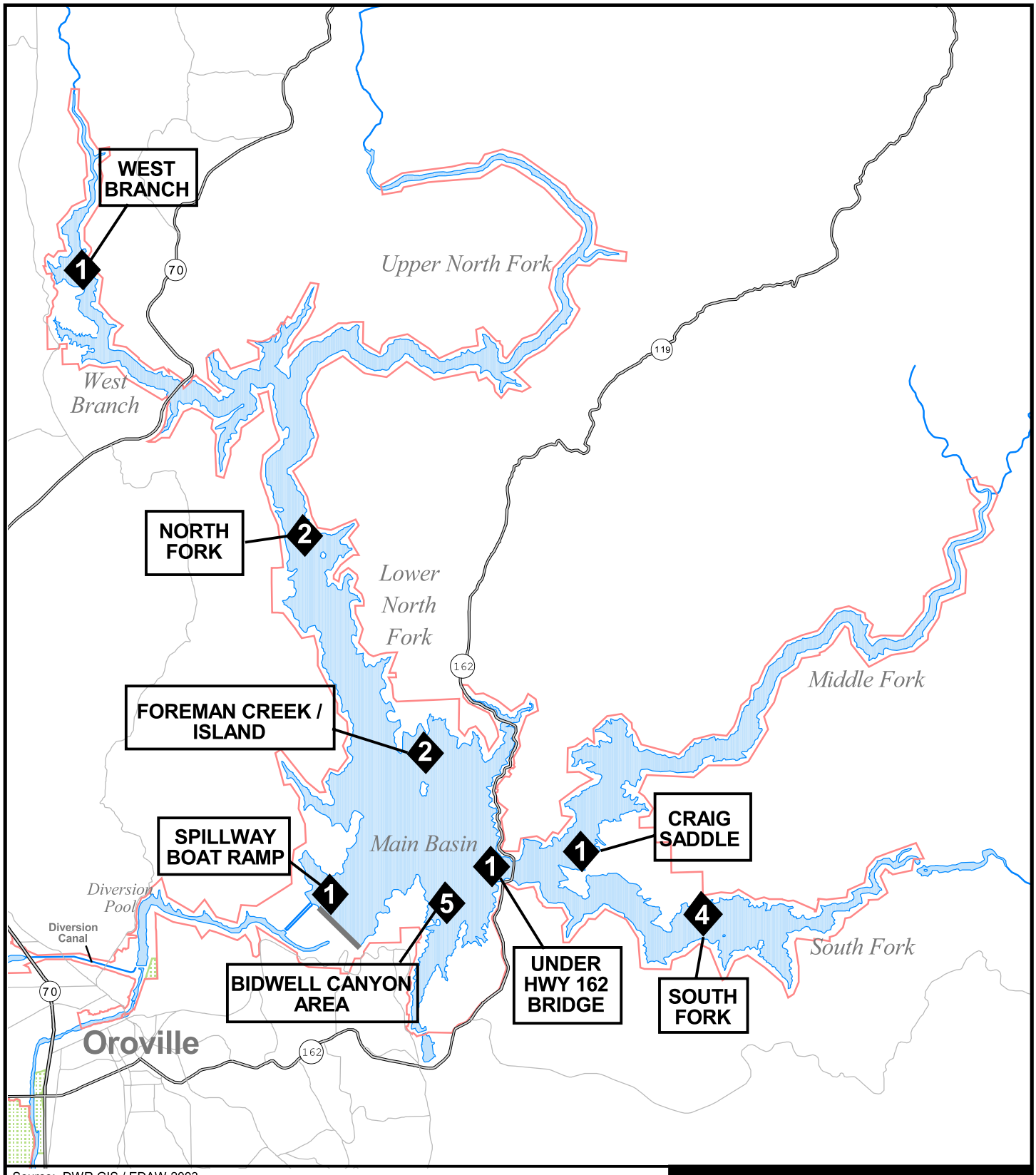
Information regarding boating accidents at Lake Oroville was obtained from DBW and DPR. Table 5.3-2 presents the reported boating accidents at Lake Oroville since 1997 by type of accident. The most common types of boating accidents

were collisions with other vessels, and skier mishaps. These two causes also led to the most boating injuries. The only fatality reported during this time period was a result of a boat capsizing. There is no clear trend in the total number of accidents over the 6 years of reported accidents, although there was a significant drop-off in the number of accidents occurring in 2002. With the exception of boats colliding and skier mishaps, the other types of accidents appear to be fairly isolated incidents.

As expected, the majority of accidents that occur at Lake Oroville are in the summer months (Table 5.3-3). Most accidents and injuries occurred in July and August, followed by June and September. There are about two-thirds as many injuries as there were accidents. These results are not surprising as it coincides with the warm weather and subsequent boating season. There have been no reported accidents in January, but every other month has had at least one accident. The only recent boating-related fatality was reported in June 1999.

Data regarding the location of boating accidents at Lake Oroville in 2002 were obtained from DPR (Table 5.3-4). The area around Bidwell Canyon had the most reported accidents in 2002, followed by the South Fork portion of the reservoir. Figure 5.3-1 shows the location of boating accidents at Lake Oroville. The total number of accidents reported by DPR does not match DBW figures as the agencies have different reporting thresholds. DBW criteria are summarized in Section 5.3.1.1. DPR prepares an incident report for only collisions to which their Rangers respond.

FIGURE 5.3-1. Location of Lake Oroville Boating Vessel Accidents – 2002



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 Miles

Scale 1 : 142,560
1" = 2.25 miles

LEGEND

Boating Vessel Accidents

3 Number of accidents by location in 2002

Jurisdictions

FERC Boundary

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities Relicensing
FERC Project No. 2100

Figure 5.3-1
(R-2)

Location of Lake Oroville Boating Vessel Accidents -- 2002

Prepared by: PJ -- EDAW, Inc. Date 1/15/04 P:\2000\0s016.gis\arcview\rec_acc.apr

BACK OF FIGURE 5.3-1.

Table 5.3-2. Reported boating accidents at Lake Oroville (1997-2002).

Type of Accidents		1997	1998	1999	2000	2001	2002	Total	Percent of Total	Annual Average
Collision with Vessel	# of accidents	4	3	0	8	2	1	18	28.6%	6
	Injuries	4	3	0	2	0	1	10	22.7%	2
	Fatalities	0	0	0	0	0	0	0	0%	0
Fall in Boat	# of accidents	1	0	0	1	0	0	2	3.2%	0
	Injuries	1	0	0	1	0	0	2	4.5%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
Skier Mishap	# of accidents	4	3	1	5	3	0	16	25.4%	3
	Injuries	4	3	1	5	3	0	16	36.4%	3
	Fatalities	0	0	0	0	0	0	0	0%	0
Struck by boat	# of accidents	1	0	0	0	0	0	1	1.6%	0
	Injuries	1	0	0	0	0	0	1	2.3%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
Collision with Fixed Object	# of accidents	0	1	0	0	4	2	5	7.9%	1
	Injuries	0	1	0	0	3	0	4	9.1%	1
	Fatalities	0	0	0	0	0	0	0	0%	0
Grounding	# of accidents	0	0	1	0	2	0	3	4.8%	1
	Injuries	0	0	0	0	3	0	3	6.8%	1
	Fatalities	0	0	0	0	0	0	0	0%	0
Falls Overboard	# of accidents	0	0	2	0	1	0	3	4.8%	1
	Injuries	0	0	2	0	2	0	4	9.1%	1
	Fatalities	0	0	0	0	0	0	0	0%	0
Capsizing	# of accidents	0	0	2	0	0	0	2	3.2%	0
	Injuries	0	0	0	0	0	0	0	0%	0
	Fatalities	0	0	1	0	0	0	1	100%	0
Fire / Explosion - Fuel	# of accidents	0	0	1	0	1	1	2	3.2%	0
	Injuries	0	0	1	0	0	0	1	2.3%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
Fire / Explosion – Other than Fuel	# of accidents	0	0	0	0	1	0	1	1.6%	0
	Injuries	0	0	0	0	0	0	0	0%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
Flooding / Swamping	# of accidents	0	0	0	2	0	0	2	3.2%	0
	Injuries	0	0	0	0	0	0	0	0%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
Other	# of accidents	1	0	1	0	0	0	2	3.2%	0
	Injuries	1	0	1	0	0	0	2	4.5%	0
	Fatalities	0	0	0	0	0	0	0	0%	0
TOTAL:	# of accidents	**11**	**7**	**8**	**16**	**14**	**4**	**63**	**100%**	**10**
	Injuries	**11**	**7**	**5**	**8**	**11**	**1**	**44**	**100%**	**7**
	Fatalities	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**100%**	**0**

Source: DBW 2003b

Table 5.3-3. Reported boating accidents by month at Lake Oroville (1997-2002).

Year		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1997	Number of Accidents	0	0	1	0	0	2	3	4	1	0	0	0	11
	Injuries	0	0	0	0	0	2	3	4	2	0	0	0	11
1998	Number of Accidents	0	0	0	0	0	0	3	3	1	0	0	0	7
	Injuries	0	0	0	0	0	0	3	3	1	0	0	0	7
1999	Number of Accidents	0	0	0	0	1	2	3	1	1	0	0	0	8
	Injuries	0	0	0	0	1	1	2	1	1	0	0	0	6
	Fatalities	0	0	0	0	0	1	0	0	0	0	0	0	1
2000	Number of Accidents	0	0	2	0	2	1	3	3	2	2	0	1	16
	Injuries	0	0	1	0	0	0	2	4	1	0	0	0	8
2001	Number of Accidents	0	0	0	1	0	2	5	4	2	1	1	0	16
	Injuries	0	0	0	0	0	3	2	3	2	1	0	0	11
2002	Number of Accidents	0	1	0	0	0	1	2	0	0	0	0	0	4
	Injuries	0	0	0	0	0	0	1	0	0	0	0	0	1
Totals	Number of Accidents	0	1	3	1	3	8	19	15	7	3	1	1	62
	Injuries	0	0	1	0	1	6	13	15	7	1	0	0	44
	Fatalities	0	0	0	0	0	1	0	0	0	0	0	0	1

Source: DBW 2003b

Table 5.3-4. Boating vessel accidents at Lake Oroville by location (2002).

Location	# of Accidents[1]
Bidwell Canyon Area	5
South Fork	4
North Fork	2
Foreman Creek / Island	2
Craig Saddle	1
Spillway Ramp	1
West Branch	1
Under Hwy. 162 Bridge	1

Source: pers. comm., Feazel 2003 (DPR).
[1]Number of accidents does not reconcile with Table 5.3.2 because some accidents included in this table did not meet the thresholds to be reported to DBW.

Table 5.3-5 compares the number of boating accidents, injuries, and fatalities at Lake Oroville with other major Northern California lakes and reservoirs. In 2001, Lake Oroville had fewer reported accidents than Shasta Lake, Folsom Lake, and Lake Berryessa, and about the same number of accidents as Lake Tahoe. In 2002, there were significantly fewer reported accidents at Lake Oroville in comparison to the other Northern California lakes. The lower accident total may be a reflection of lower use in 2002, but otherwise may suggest an encouraging trend. In comparison, Shasta Lake had 57 boating accidents in 2001 and 60 accidents in 2002, the most of any Northern California lake or reservoir. Shasta Lake also had the most boating injuries, with 27 in 2001 and 35 in 2002 (DBW 2002, 2003a).

Table 5.3-5. Reported accidents at major Northern California lakes and reservoirs (2001-2002).

Lake/Reservoir	Year	Number of Reported Accidents	Injuries	Fatalities
Lake Oroville	2001 2002	15 4	11 1	0 0
Shasta Lake	2001 2002	57 60	27 35	3 1
Folsom Lake	2001 2002	24 21	11 19	1 0
Lake Tahoe	2001 2002	15 20	5 14	0 0
Lake Berryessa	2001 2002	23 33	21 21	1 1
Northern California[1] (Total)	2001 2002	477 475	256 246	37 27

Source: DBW 2002, 2003a
[1]Data for Northern California also includes non-lake areas including the Sacramento-San Joaquin Delta and San Francisco Bay

Water Depth and Safety

Typical of most Northern California reservoirs, Lake Oroville exhibits great variation in reservoir water level from one year to another and even within a year. For example, the reservoir level was below 700 feet elevation toward the end of 2002, yet spring rain storms along with snowmelt brought the reservoir level near 900 feet (full pool) in May 2003. There is a dramatic difference in surface acreage (8,000 acres to over 15,000 acres, respectively) between these two conditions. Less surface area could lead to increased boat density that may conceivably lead to more boating-related accidents. Boating hazards also are different depending on varying water depths – submerged objects can become hazards as the reservoir level lowers, as it normally does during the summer season.

Table 5.3-6 displays the number of accidents occurring at different pool levels at Lake Oroville for summer months between 1997 and 2002.

Table 5.3-6. Accidents and water depth: Lake Oroville, June – September (1997-2002).

Variable – Reservoir Level Range	Reservoir Elevations (feet msl)			
	850-900	800-849	750-799	700-749
Number of days at reservoir level	261	195	180	96
Number of reported accidents	16	16	12	6
Number of days per accident	16	12	15	16

Source: EDAW (2003)

PWC- Related Accidents

The 2001 and 2002 California Boating Safety Reports (DBW 2002, 2003a) address PWC-related accidents in California. In 2001, PWCs represented 19 percent of the registered watercraft in California, but were involved in 30 percent of the accidents and represented 43 percent of the injuries. In 2002, they accounted for 18 percent of registered watercraft in California and were involved in 28 percent of the reported accidents. Accidents involving PWC use have declined significantly in the State since 1997 (Table 5.3-7). This statewide trend is consistent with the apparent trend at Lake Oroville (Table 5.3-8). There were 391 reported accidents in 1997 and 253 in 2002. DBW attributes this change to two new laws that took effect in 1998. The first raised the minimum age to operate a PWC from 12 to 16 years old. The other law prohibits wake jumping within 100 feet of other watercraft. It is also important to note that most (72 percent) of the accidents attributed to PWC use involved renters or borrowers of PWCs. The most common causes of boating accidents involving PWCs are: operator inexperience, excessive speed, and operator inattention. The DBW reports cite that PWC use accounts for a disproportionately high number of accidents even when accounting for time on the water. There is 1 accident for every 666 hours of PWC operation on California waterways, compared to 1 accident for every 788 hours of operating conventional watercraft.

Table 5.3-7. Reported accidents involving PWC use in California (1995-2002).

Variable	Year								Average
	1995	1996	1997	1998	1999	2000	2001	2002	
Number of Reported Accidents	353	385	391	229	264	293	273	253	305
Number of Injuries	226	298	276	161	215	238	216	189	227
Number of Fatalities	6	8	8	9	8	6	5	7	7

Source: DBW 2003a

Table 5.3-8. Reported boating accidents involving PWC use at Lake Oroville (1997-2002).

Variable	Year						Average
	1997	1998	1999	2000	2001	2002	
Reported Accidents at Lake Oroville Involving Personal Water craft	6	1	1	4	2	2	3
Percentage of Total Reported Accidents	55%	14%	13%	25%	14%	50%	25%

Source: DBW 2003b

5.3.1.3 Thermalito Afterbay Boating-Related Accidents

Boating accident data for the Thermalito Afterbay were obtained from DBW. Table 5.3-9 presents the number and types of boating accidents that occurred at Thermalito Afterbay from 1997 to 2002. The vast majority of accidents and injuries at Thermalito Afterbay were caused by boater collisions with other vessels. One fatality at the Afterbay was caused by a fall overboard.

Table 5.3-9. Reported boating accidents at Thermalito Afterbay (1997-2002).

Type of Accidents	Details	Year							Percent of Total
		1997	1998	1999	2000	2001	2002	Total	
Collision with Vessel	# of accidents	1	0	1	2	1	1	6	75.0%
	Injuries	1	0	0	4	1	1	7	100.0%
	Fatalities	0	0	0	0	0	0	0	0%
Grounding	# of accidents	0	0	1	0	0	0	1	12.5%
	Injuries	0	0	0	0	0	0	0	0%
	Fatalities	0	0	0	0	0	0	0	0%
Falls Overboard	# of accidents	0	0	0	0	1	0	1	12.5%
	Injuries	0	0	0	0	0	0	0	0
	Fatalities	0	0	0	0	1	0	1	100.0%
TOTAL:	# of accidents	**1**	**0**	**2**	**2**	**2**	**1**	**8**	**100.0%**
	Injuries	**1**	**0**	**0**	**4**	**1**	**0**	**7**	**100.0%**
	Fatalities	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**100.0%**

Source: DBW 2003b

Table 5.3-10 presents the number of accidents, injuries, and fatalities by month at Thermalito Afterbay. Unlike Lake Oroville, over the last 6 years the month with the most reported accidents and injuries at the Thermalito Afterbay was April. Interestingly, even February had more reported accidents than any summer

month. The only reported boating fatality at the Afterbay in the last six years was during April 2001.

5.3.2 Incident Reports

Another concern for recreation users and managers in the study area is personal safety. A review of incident summaries provided by DPR was done to evaluate potential safety issues affecting recreation users in the study area. Table 5.3-11 shows a summary of incidents that occurred at least 10 times in 2002 at LORSA. Many of the incidents at LORSA are alcohol-related, results consistent with what area land managers and law enforcement have cited.

A review of incident reports and summaries provided by DWR covering incidents at Project facilities since 1995 was conducted by researchers. The results show a wide variety of incidents occurring at these facilities including fights, shoreline drownings (particularly near boat ramps), bee stings, vandalism of State property, and lighting fire to toilet paper in restrooms among others. Upon review by researchers, these incidents appear to be isolated and unrelated events.

5.4 FIELD OBSERVATIONS OF POTENTIAL HAZARDS

In coordination with other studies, areas within the study area were examined by conducting field work. The only significant issues that were noted during this field reconnaissance were the presence of floating debris, and the potential for conflict at the Afterbay Outlet. Floating debris was most noticeable during the spring. There were also rock outcroppings, in particular near the Lime Saddle area, but they do not appear to be boating hazards. Stumps were also noticed in the McCabe Creek area, but most of the area was buoyed to inform boaters of the potential hazard. As a general safety measure, boating speed close to shore where submerged hazards are located is limited to 5 mph at all times.

As observed during the field reconnaissance, debris floating on the water surface can be a potential hazard. Debris can also be a hazard at launch ramps and docks. The spring rains and snowmelt bring a significant amount of debris (mostly wood) into the reservoir. To the extent practicable, DWR clears the debris and brings it to coves around the reservoir, including McCabe Creek. The debris then collects along the shore as the water level drops throughout summer and fall. In certain areas, DPR allows non-commercial collection of wood below full pool (Langley 2003). DWR plans to continue to collect the wood and monitor the effectiveness of the program.

Table 5.3-10. Reported boating accidents by month at Thermalito Afterbay (1997-2002).

Year		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1997	Number of Accidents	0	0	0	0	1	0	0	0	0	0	0	0	1
	Injuries	0	0	0	0	1	0	0	0	0	0	0	0	1
1998	Number of Accidents	0	0	0	0	0	0	0	0	0	0	0	0	0
	Injuries	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	Number of Accidents	0	2	0	0	0	0	0	1	0	0	0	0	3
	Injuries	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	Number of Accidents	0	0	0	1	0	0	1	0	0	0	0	0	2
	Injuries	0	0	0	2	0	0	2	0	0	0	0	0	4
2001	Number of Accidents	0	0	0	2	0	0	0	0	0	0	0	0	2
	Injuries	0	0	0	1	0	0	0	0	0	0	0	0	1
	Fatalities	0	0	0	1	0	0	0	0	0	0	0	0	1
2002	Number of Accidents	0	0	0	0	0	1	0	0	0	0	0	0	1
	Injuries	0	0	0	0	0	1	0	0	0	0	0	0	0
Totals	Number of Accidents	0	2	0	3	1	1	1	1	0	0	0	0	9
	Injuries	0	0	0	3	1	1	2	0	0	0	0	0	7
	Fatalities	0	0	0	1	0	0	0	0	0	0	0	0	1

Source: DBW 2003b

Table 5.3-11. Incidents at Lake Oroville State Recreation Area (2002).

Types of Violations at Lake Oroville State Recreation Area[1]	Number of Incidents (2002)
Vandalism	30
Driving under the influence	29
Minor in possession (of alcohol)	26
Petty theft	20
Trespassing on railroad lands	19
Driving with a suspended license	15
Drunk in public	15
Auto / boat burglary	14
Trespassing	12
Warrant	10

[1] *Includes those incidents that occurred 10 or more times during 2002. DPR (2003)*

The area near the Thermalito Afterbay outlet area was observed during salmon fishing season because it had been noted by land managers as an area where conflict had occurred. There were many anglers in the area (some shoulder to shoulder), fishing lines were getting crossed, and some anglers attempted to reach areas that were cordoned off due to the hazard produced by the water flowing from the Afterbay into the Feather River. Although no serious conflict was noted while at the site, the potential for conflict and safety issues related to trespass were apparent.

It is important to note that DWR installed a siren to warn visitors downstream of the Dam if a release of water from the spillway of greater than 1000 cfs is about to occur. The alarm will sound for three minutes, both during the daytime and the nighttime. This will warn users below the dam who may be wading, fishing, or swimming in the water that the water may rise rapidly in the low flow area.

5.5 Radio and Cellular Phone Coverage for Calling Assistance

Communication is a potential recreation safety issue, as the ability to contact authorities when needed is important, especially in potentially life threatening situations. Visitors within the study area in locations with poor cellular or radio coverage may potentially be at additional risk as response times to incidents in these areas can be significantly longer. During data collection for this portion of the study, it was noted that coverage could change along with weather conditions. One day a site may have very poor coverage, whereas the next day coverage may improve significantly, depending on the weather conditions.

Two cellular phones representing two major providers (Verizon and Sprint Wireless) were tested at each site as were two different radios (one used by DPR, the other by DWR). Different areas within each site were tested to determine the extent of coverage. Results, as shown in Table 5.5-1, are divided into three categories:

- **Good** – Coverage at these sites are generally good. The site may have a few pockets of poor coverage.
- **Intermittent** - Coverage may be good in some areas within the site, but generally the site has weak signal strength and spotty coverage. This term is also used to identify sites in which coverage may be inconsistent due to weather conditions from day to day.
- **Poor** – These sites have little or no coverage. In areas that there is coverage, the signal is typically weak, although during certain weather conditions, coverage may be good.

Based on the field studies, three sites have poor cellular coverage including Dark Canyon Car-Top Boat Ramp, Nelson Bar Car-Top Boat Ramp, and Vinton Gulch Car-Top Boat Ramp. The only site with poor radio communication was Vinton Gulch Car-Top Boat Ramp, which incidentally is the only site with both poor cellular and radio communications. These results are depicted in Figures 5.5-1 and 5.5-2. Southern portions of the OWA were not tested, however, given the proximity to Oroville and lack of topography, the coverage is likely good.

Cellular phone coverage is not as good on the reservoir as radio coverage (Figure 5.5-3). The areas with intermittent or poor cell phone coverage on the reservoir include: Potters Ravine, the area around Foreman Creek, the Middle and South Fork arms east of the Highway 162 Bridge, and most of the North Fork arm of the reservoir (although Bloomer Cove has good coverage).

Overall, radio coverage on the reservoir is generally good (Figure 5.5-4). However, a few areas on the reservoir have intermittent coverage, including Potters Ravine, the West Branch of the North Fork above Lime Saddle, the North Fork above Berry Creek, the Middle Fork above and below Falls River, and along the South Fork arm east of the Enterprise Bridge.

5.6 Wildland Fire Safety

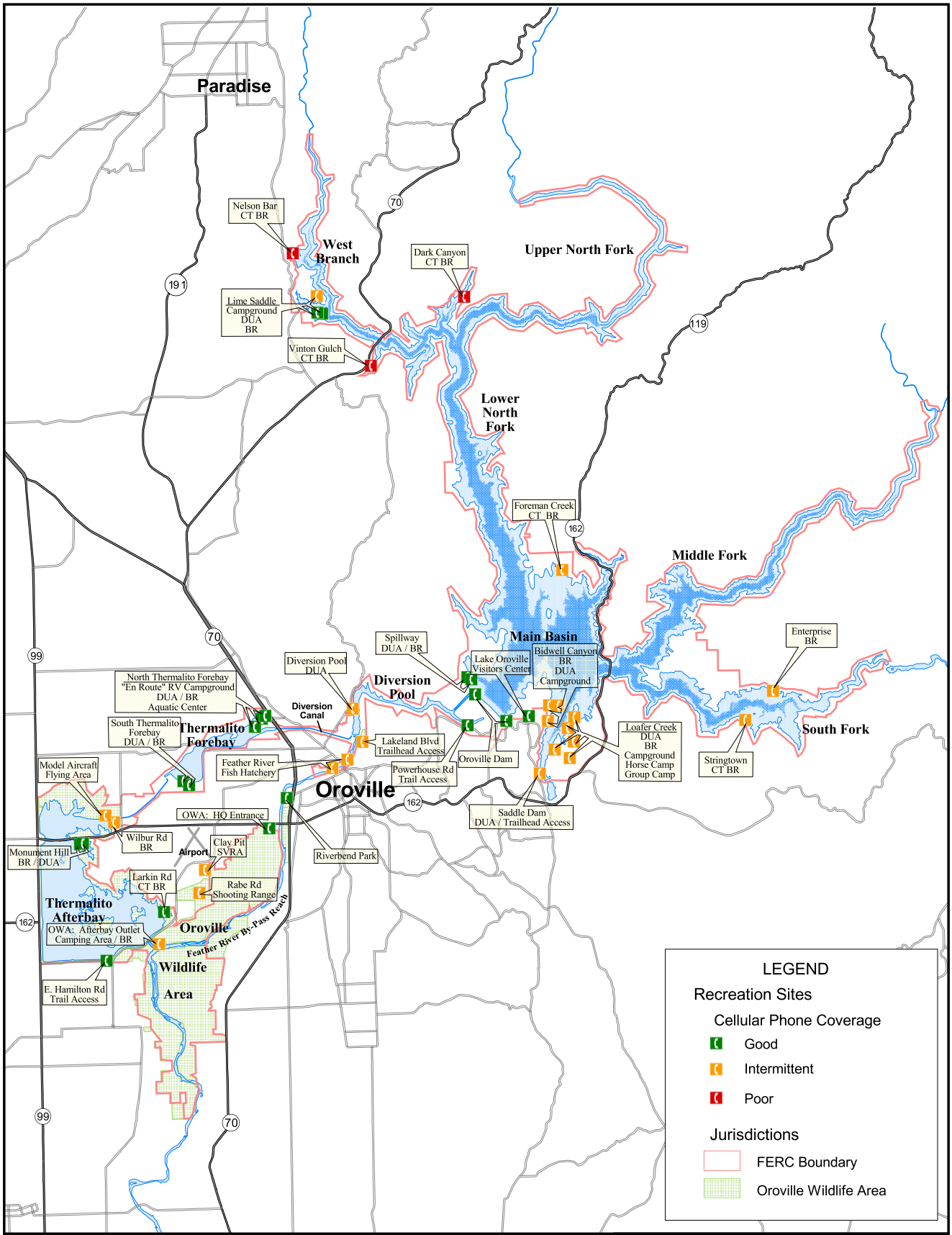
Wildland fires are an historic concern in the study area because of the climate, vegetation, and activities in the area. Recreational use of the area can potentially lead to wildland fires (e.g., uncontrolled campfires, careless smoking, unauthorized vehicle use, etc.) which may cause recreational areas to be evacuated. Some of the primary effects of wildland fires on recreation include a degradation in the aesthetic quality of the area (both during and after the fire), visitor inconvenience due to temporarily-closed recreation sites and access roads, air quality degradation related to excessive smoke that may be irritating and hazardous to some visitors, and loss of structures and use areas. Severe wildland fires and the subsequent loss of recreational opportunities can result in significant economic loss in an area. While public safety has generally not been directly threatened by past wildland fires in the study area, the potential exists for interactions between visitors and wildfires.

Table 5.5-1. Cellular phone and communication radio coverage at Project recreation facilities (2003).

Recreation Site	Cellular Phone Coverage	Communication Radio Coverage
Day Use Areas		
Bidwell Canyon Boat Ramp and DUA	Intermittent	Good
Diversion Pool DUA	Intermittent	Good
East Hamilton Trail Access	Good	Intermittent
Feather River Fish Hatchery	Intermittent	Good
Kelly Ridge DUA	Good	Good
Lakeland Blvd Trail Access	Intermittent	Intermittent
Lime Saddle Boat Ramp and DUA	Good	Good
Loafer Creek DUA	Intermittent	Good
Model Airplane Facility	Intermittent	Good
North Forebay DUA and Aquatic Center	Good	Good
Oroville Dam Overlook Area	Good	Good
OWA Afterbay Outlet	Intermittent	Good
OWA Clay Pit Shooting Area	Intermittent	Good
OWA Clay Pit Vehicular Recreation Area	Intermittent	Intermittent
OWA Headquarters	Good	Good
Powerhouse Road Trail Access	Good	Good
Riverbend Park	Good	Good
Saddle Dam DUA	Intermittent	Good
South Forebay Boat Ramp and DUA	Good	Good
Spillway Boat Ramp and DUA	Good	Good
Campgrounds		
Bidwell Canyon Campground	Intermittent	Good
Lime Saddle Campground	Intermittent	Intermittent
Loafer Creek Campground	Intermittent	Intermittent
Loafer Creek Equestrian Camp	Intermittent	Good
Loafer Creek Group Campground	Intermittent	Intermittent
Boat Ramps		
Enterprise Boat Ramp	Intermittent	Intermittent
Loafer Creek Boat Ramp	Intermittent	Good
Monument Hill Boat Ramp	Good	Good
Wilbur Road Boat Ramp	Intermittent	Good
Car-Top Boat Ramps		
Dark Canyon Car-Top Boat Ramp	Poor	Good
Foreman Creek Car-Top Boat Ramp	Intermittent	Good
Larkin Road Car-Top Boat Ramp	Good	Good
Nelson Bar Car-Top Boat Ramp	Poor	Good
Stringtown Car-Top Boat Ramp	Intermittent	Intermittent
Vinton Gulch Car-Top Boat Ramp	Poor	Poor

Source: EDAW Inc. (2003)

INSERT FIGURE 5.5-1 HERE Cellular Phone Coverage



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 Miles

Scale 1 : 142,560
1" = 2.25 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities Relicensing
FERC Project No. 2100

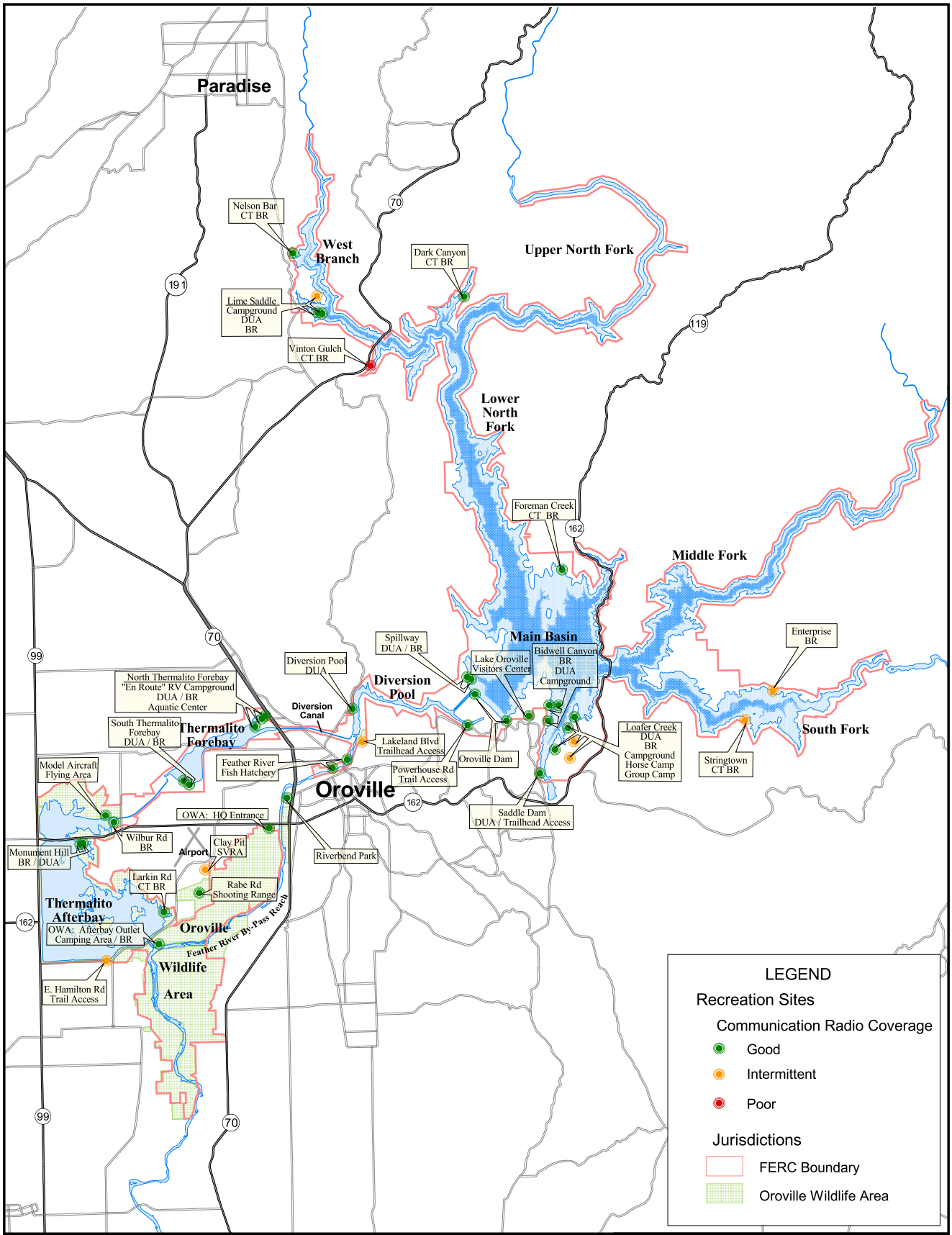
Figure 5.5-1
(R-2)

Cellular Phone Coverage

Prepared by: PJ -- EDAW, Inc. Date 1/15/04 P:\2000\0s016.gis\arcview\rec_acc.apr

BACK OF FIGURE 5.5-1

INSERT FIGURE 5.5-2 HERE Communication Radio Coverage



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 Miles

Scale 1 : 142,560
1" = 2.25 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities Relicensing
FERC Project No. 2100

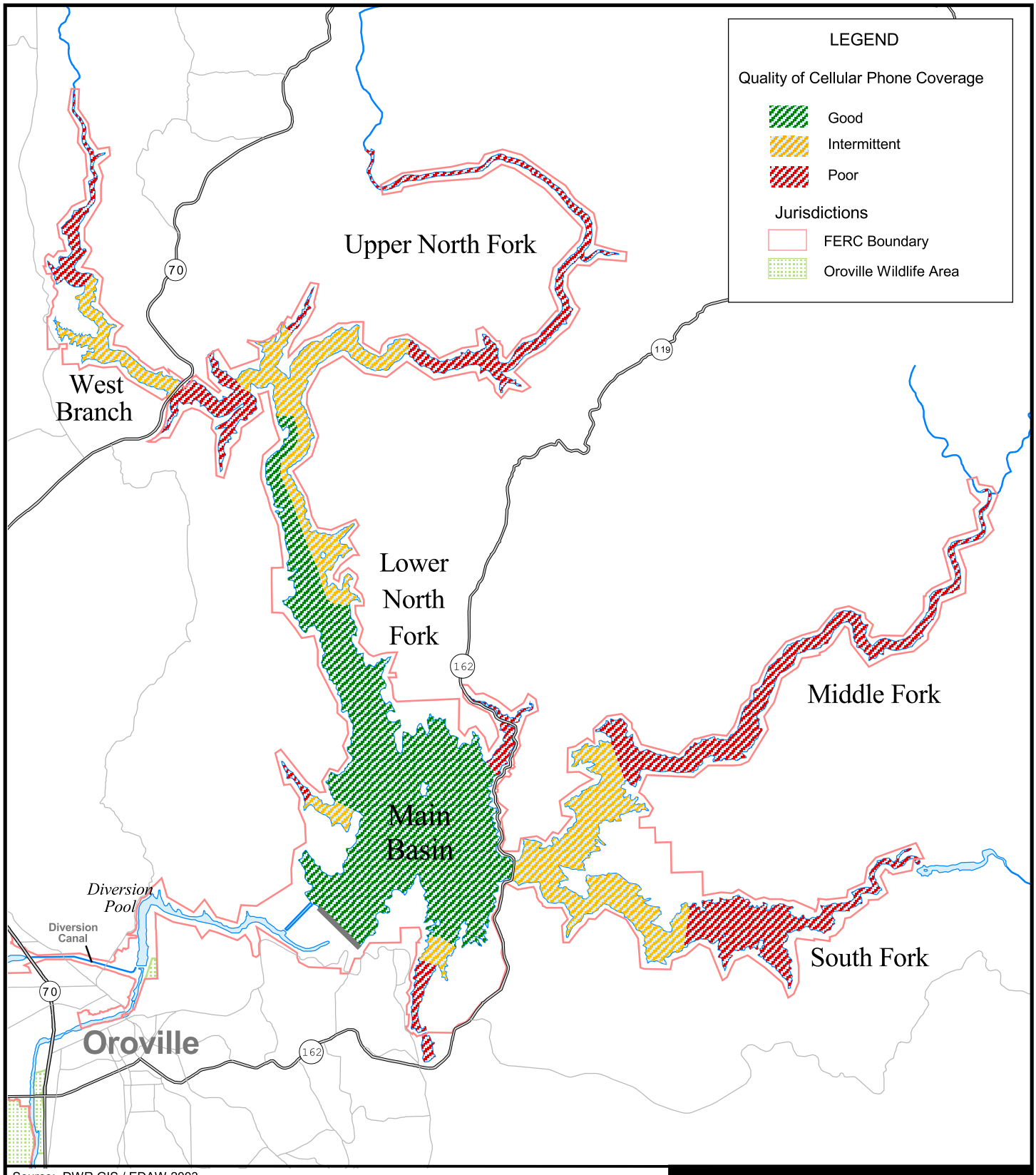
Figure 5.5-2
(R-2)

Communication Radio Coverage

Prepared by: PJ -- EDAW, Inc. Date 1/15/04 P:\2000\0s016.gis\arcview\rec_acc.apr

BACK OF FIGURE 5.5-2

INSERT FIGURE 5.5-3 HERE



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 Miles

Scale 1 : 142,560
1" = 2.25 miles

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Figure 5.5-3
(R-2)

Cellular Phone Coverage on Lake Oroville

Prepared by: PJ -- EDAW, Inc. Date 1/15/04 P:\2000\0s016.gis\arcview\rec_acc.apr

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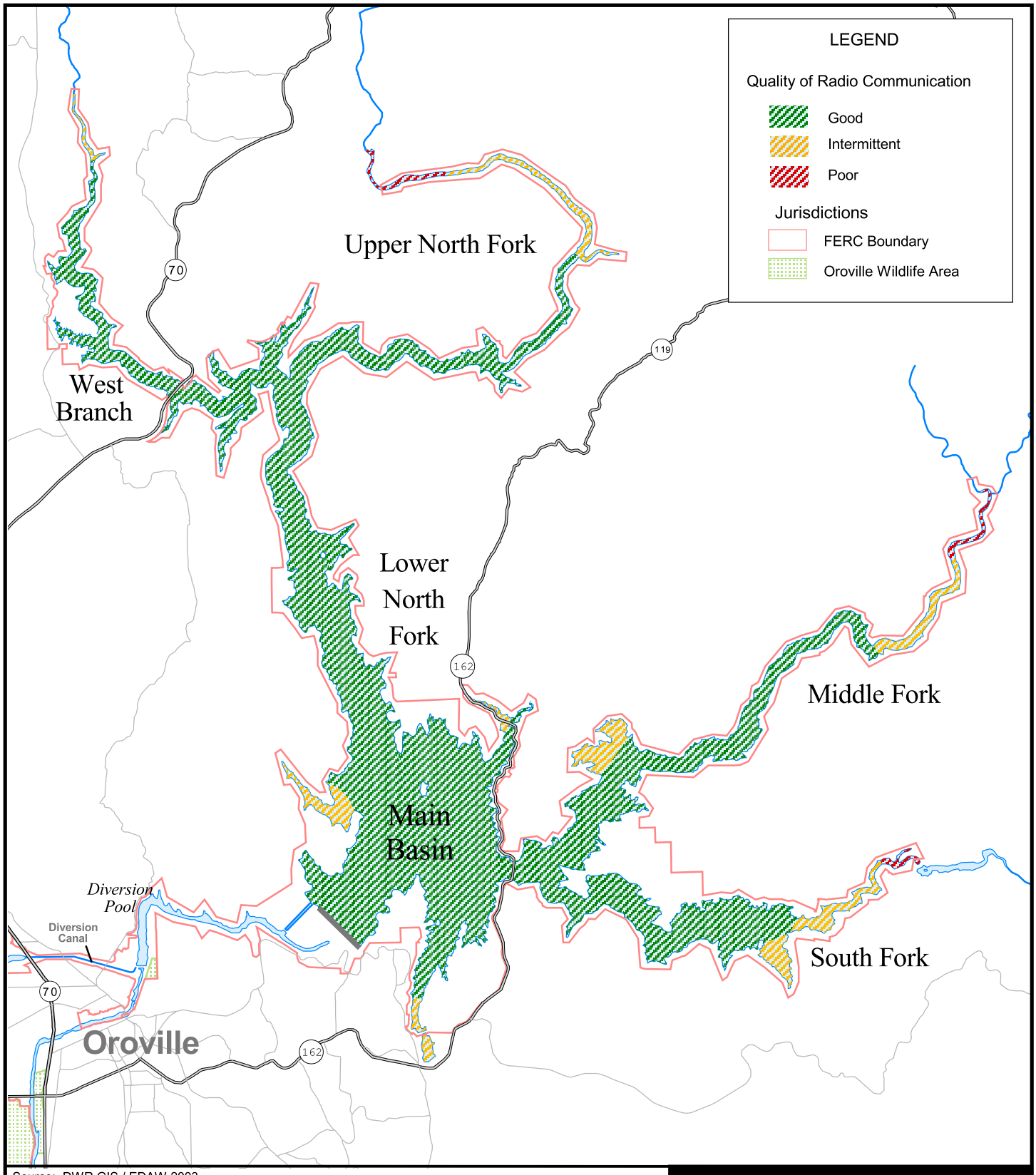

Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 Miles

Scale 1 : 142,560
1" = 2.25 miles

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Figure 5.5-4
(R-2)

Radio Communication on Lake Oroville

Prepared by: PJ -- EDAW, Inc.
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This section describes wildland fire issues as they relate to recreation and public use of the study area and is composed of three subsections:

- A summary of the historical occurrence of wildland fires in the study area;
- Potential future threats of wildland fires in the study area; and
- Evacuation, rescue, and other safety policies and procedures associated with wildland fires in the study area.

5.6.1 Historical Occurrence of Wildland Fires in the Study Area

For thousands of years, wildland fires have influenced many California plant habitats and communities, particularly those found within the Sierra Nevada (Barbour et al. 1987). The typical California climate, characterized by cool wet winters and warm/hot dry summers, predisposes many natural areas to the frequent re-occurrence of fire. Before Euro-American settlement in California, fires in the Sierra Nevada often occurred at return intervals of about 5 to 50 years. Since Euro-American settlement, wildland fire policies and management that emphasize suppression have resulted in existing conditions that more readily support severe fire due to vegetation structure and the accumulation of fuel (McKelvey et al. 1996).

CDF maintains a geographic information system (GIS)-based database of past fires (approximately the past 100 years) and the approximate location and cause of their ignition. Fires that are mapped by CDF include timber fires of at least 10 acres, brush fires of at least 50 acres, and grassland fires of at least 300 acres. Figure 5.6-1 displays fires, including their causes that have recently occurred in the vicinity of study area (CDF 2002a). Very few of the recorded fires from the past 100 years occurred as a result of recreational use of the study area. However, many of the fires were caused by unknown or unidentified sources, some of which could potentially have been recreational use. CDF also tracks fire ignitions (cause, location, etc.), regardless if a wildfire of recordable size results.

Since 1990, CDF has recorded nearly 400 fire ignitions in the study area (CDF 2002b). The most recorded cause of wildfire ignitions in the study area vicinity was the use of equipment. Table 5.6-1 lists the causes and the number of ignitions that have been recorded in the study area vicinity since 1990. During this time period, recreational campfires have accounted for about 2 percent of ignitions, suggesting that recreational use of the study area is likely not a major cause of wildland fires.

Table 5.6-1. CDF-recorded causes of wildfire ignitions in the study area vicinity (1990-2002).

Cause	Number of Ignitions
Use of equipment	96
Unknown/unidentified	63
Miscellaneous	61
Arson	55
Burning of debris/garbage	28
Vehicle	27
Playing with fire	18
Power line	15
Smoking	13
Lightning	8
Campfire	8
Railroad	5
Total	**397**

Source: CDF 2002b

Using a CDF wildfire fuel hazard model, areas within the study area were classified as moderate, high, or very high fuel hazard based on their potential threat of wildfire (Figure 5.6-2). Approximately half (53 percent) of the study area is classified as a moderate fuel hazard, 32 percent is classified as a high fuel hazard, and 15 percent is classified as a very high fuel hazard (CDF 2002d). Table 5.6-2 presents the wildfire fuel hazard classifications for sub-areas within the study area by percent and acres.

Table 5.6-2. Wildfire fuel hazard zones in the study area.

Area	Fuel Hazard Classifications		
	Moderate (acres)	**High (acres)**	**Very High (acres)**
Lake Oroville	22% (15,530)	28% (19,700)	15% (10,730)
Diversion Pool and Thermalito Forebay	7% (4,940)	4% (2,750)	-
Thermalito Afterbay	12% (8,480)	0 % (0)	0 % (0)
Bypass Reach and Oroville Wildlife Area	12% (8,480)	0 % (0)	0 % (0)
Study Area Total	**53% (37,430)**	**32% (22,450)**	**15% (10,730)**

Source: CDF 2002d

5.6.2 Future Threats of Wildland Fires in the Study Area

Prior to Euro-American settlement, fires were not suppressed. Native Americans were known to frequently use fire for cultural purposes. Cultural purposes included food production (e.g., promoting desirable species such as oaks for acorn production by using fires to control competing understory vegetation) and basket weaving, among others (McKelvey et al. 1996). After Euro- American settlement, fire suppression was widely implemented to protect property and homes, as well as commercial timber resources. Fire suppression has resulted

Figure 5.6-1. Fire History in the Oroville Relicensing Study Area and Vicinity.

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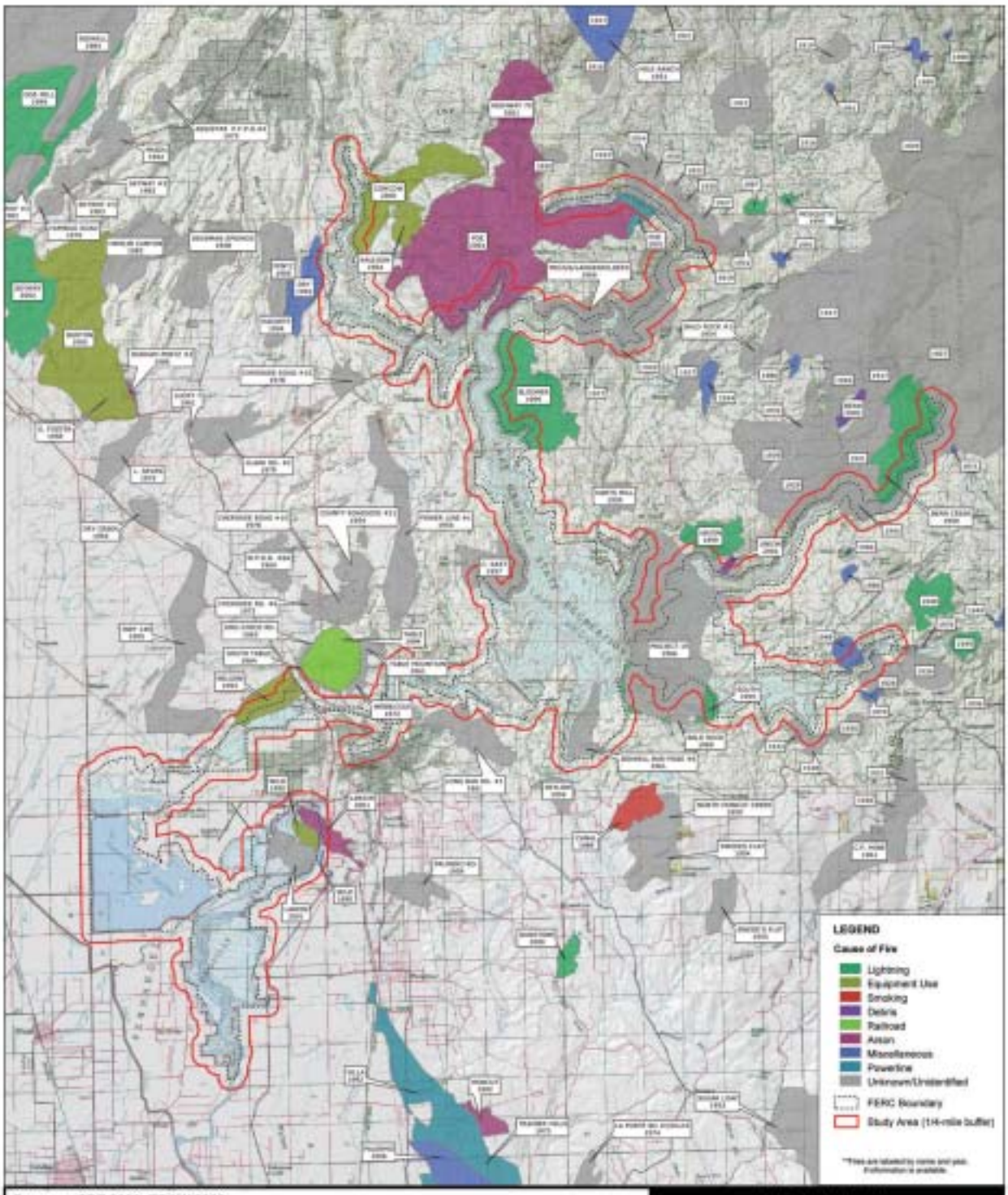

Sources: CDF 2003, EDAW 2003

0 8,000 16,000 Feet

0 2.5 5 Miles

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Figure 5.6-1

Wildfire History in Oroville Relicensing Study Area and Vicinity

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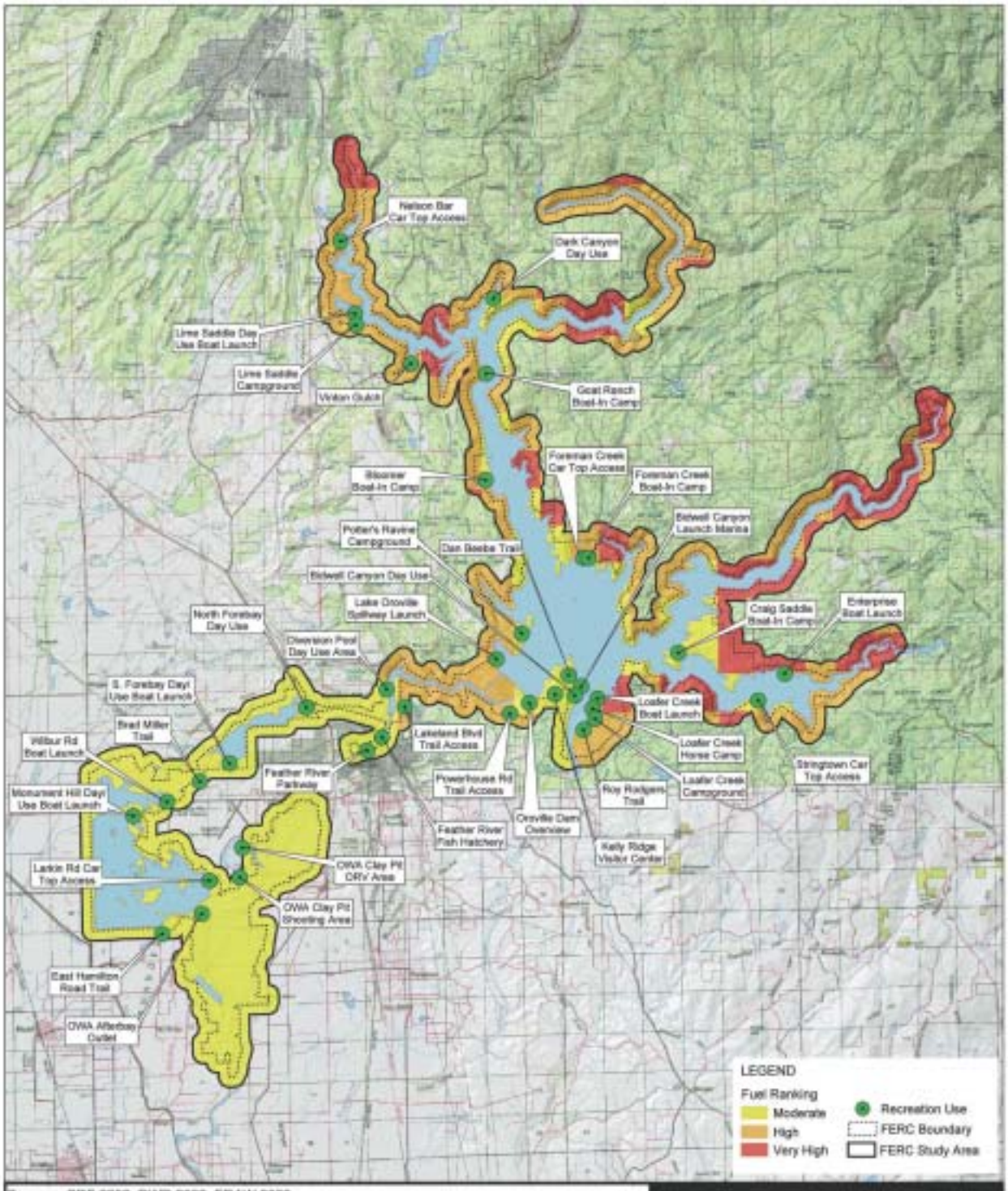
Figure 5.6-2. Fuel Hazard Ranking within the Study Area.



Sources: CDF 2002, DWR 2002, EDAW 2003

0 8,000 16,000 Feet

0 2.5 5 Miles

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Oroville Facilities Relicensing
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Figure 5.6-2

Wildfire Fuel Hazard Ranking within the Study Area

Prepared by: LC - EDAW Inc. Date: 01/15/04

Back of Figure 5.6-2.

in an increase in fuel loads and the threat of high severity wildfires that many land managers have described as the greatest single threat to the integrity and sustainability of Sierra Nevada habitats and communities, as well as people, structures, and watersheds (CDF 2002c).

Figure 5.6-2 also displays recreation sites in the study area in relation to the wildfire fuel hazard zones. Recreation sites are potential ignition areas for wildland fires (e.g., uncontrolled campfires, smoking, vehicle use, etc.), especially in areas that have a very high fuel hazard ranking. Table 5.6-3 presents the study area recreation sites and their corresponding fuel hazard ranking. None of the existing developed recreation sites in the study area are located within an area categorized as very high fuel hazard, although several are located adjacent to very high fuel hazard areas. Ten recreation sites are located in areas categorized as having a high fuel hazard. The majority of developed recreation sites in the study area, however, are located in moderate fuel hazard areas. The entire OWA is considered a moderate fuel hazard area.

Table 5.6-3. Recreation sites within wildfire fuel hazard zones in the study area.

Fuel Hazard Classifications		
Moderate	**High**	**Very High**
Campgrounds		
Afterbay Outlet Campground and Day Use Area		
Bidwell Canyon Campground	Foreman Creek BIC	None
Bloomer Boat-in Campground (BIC)	Lime Saddle Campground	
Craig Saddle BIC	Loafer Creek Campground	
Goat Ranch BIC		
Day Use Areas (DUA)		
Lake Oroville Visitor Center	Lime Saddle DUA	None
Bidwell Canyon DUA	Spillway DUA	
Loafer Creek DUA		
Oroville Dam Overlook Area		
Saddle Dam DUA		
North Thermalito Forebay DUA		
South Thermalito Forebay DUA		
Monument Hill DUA		
Wilbur Road DUA (Thermalito Afterbay)		
Larkin Road DUA (Thermalito Afterbay)		
Lakeland Boulevard DUA		
Boat Ramps		
Loafer Creek Boat Ramp (BR)	Lime Saddle BR	None
Bidwell Canyon BR	Nelson Bar Car-Top BR	
Enterprise BR	Foreman Creek Car-Top BR	
South Thermalito Forebay	Dark Canyon Car-Top BR	
Diversion Pool	Vinton Gulch Car-Top BR	
Stringtown Car-Top BR		
Monument Hill BR		
North Thermalito Forebay		

Source: CDF 2002d, EDAW, Inc.

While potential future wildland fires may result from natural and/or human actions, existing and future fuel load conditions will likely influence the size, severity, and duration of future wildland fires in the study area. It is often possible to manage fuel load conditions to help reduce the potential of large, devastating wildland fires and their effect on recreation and public use. Education, well-designed sites, and seasonal fire restrictions are management techniques that can help reduce the potential of a recreation-caused wildland fire in the study area. A more detailed analysis of fuel load conditions and management is presented in the Fuel Load Management Evaluation Report (Study L-5).

5.6.3 Fire Management Policies and Evacuation/Rescue Procedures

Agencies at the federal, State, and local (county, city, district) level within the study area all have fire management policies and procedures. The USFS, CDF, and DPR are responsible for the primary fire management programs in and directly adjacent to the study area. However, several other agencies also have fire management or fire suppression policies for lands within the study area. These agencies include the BLM, DFG, Butte County, and the City of Oroville. Table 5.6-4 lists the fire policy documents for each agency with fire management responsibilities in the study area.

Table 5.6-4. Federal, State, and local fire management policies and plans in the study area.

Agency	Document Title	Date
Federal		
USFS	Healthy Forest Initiative	2002
USFS	Sierra Nevada Forest Plan Amendment, Record of Decision	2001
USFS	Plumas and Lassen National Forests, Proposed Administrative Study	2002
BLM	Redding Resource Management Plan	1993
State		
CDF and State Board of Forestry and Fire Protection (SBF)	The California Fire Plan	1996
CDF	Butte Unit Fire Management Plan	2002c
DPR	Wildfire Management Planning: Guidelines and Policy	2002
DPR	Loafer Creek Prescribed Fire Management Plan, Lake Oroville State Recreation Area	1999
DFG	Oroville Wildlife Area Management Plan	1978
Local		
City of Oroville	General Plan and Implementing Regulations and Codes	1995
Butte County	General Plan and Implementing Regulations and Codes	1996

Source: EDAW 2003

Each of these fire policy documents is described in detail in the Fuel Load Management Evaluation Report. While each of the documents listed in Table 5.6-4 contains specific policies and procedures to each managing agency, they all share the common goal of reducing the potential risks, costs, and losses resulting from wildland fires. Reducing the number and severity of wildland fires is achieved by each agency through a variety of fire management techniques including fire suppression, fuel load management, and prescribed burns. While recreation is often mentioned in these documents as being at risk from wildland fires, specific information on recreation and wildland fire safety (including evacuation, rescue, and prevention) is generally not provided. DPR fire management documents, however, provide a more detailed discussion of visitor safety as it relates to wildland fires.

In a DPR document called Wildfire Management Planning (DPR 2002), a sample outline is provided for the development of a wildfire management plan. This outline describes what should be included in a wildfire management plan. The DPR wildfire management plan outline is separated into three sections: (1) Before the Fire, (2) During the Fire, and (3) After the Fire. Most recreation-specific information in the DPR fire management plan outline is contained in the "Before the Fire" and "During the Fire" sections. Public information techniques and alert levels are discussed, as well as recreation management techniques including visitor education (e.g., campfire talks, signs, posters, and notices on bulletin boards) and information (e.g., smoking restrictions, open fire restrictions, fireworks restrictions, and fire danger severity). During moderate to extreme fire conditions, smoking and open fire restrictions are put in place, and recreation areas may be closed depending on fire criteria (e.g., weather, fuel load, etc.).

Protection priorities and evacuation procedures are detailed in the fire management plan. During a fire, protecting human life, property, and natural/cultural resources are the fire fighting protection priorities of the agencies tasked with wildland fire fighting responsibilities. To protect human lives during a wildland fire, recreation sites in the vicinity of the fire should be closed and all visitors, concessionaires, and employees evacuated. Property and natural/cultural resources should be prioritized based on their relative value.

A DPR fire management plan was prepared in 1999 for the Loafer Creek area, prior to the development of, but still generally consistent with, the new DPR (2002) guidelines. The 1999 DPR Loafer Creek plan aims to reduce the hazard of wildfire in developed areas while perpetuating the natural processes of plant succession (DPR 1999). The plan focuses primarily on controlled burning as a means of minimizing the potential of a large, devastating fire and outlines an ongoing monitoring program that tests the efficiency and effectiveness of fuel load management techniques. The DPR Loafer Creek plan also provides some information regarding the threat of wildfires to and from recreational use of the area.

In addition to the plans listed in Table 5.6-4, several other agencies and organizations, including the USFS (Cohen 1999; Moore 1981), Fire Safe Council (Fire Safety Council Website) and Firewise (Firewise Website), provide information to residents and visitors regarding the threat of wildland fires. However, most of this information focuses on techniques to protect private residences from the threat of wildland fires. CDF also provides information to residents of fire-prone areas, as well as some limited information regarding campfire permits and campfire safety (CDF 2003). Campfire permits are required only on federal lands (i.e., lands managed by the USFS, National Park Service [NPS], and BLM), as well as on private lands (campfires on private lands also require the permission of the landowner). While the USFS, BLM, NPS, and CDF can issue campfire permits, local authorities retain the right to restrict and suspend campfires based on daily fire conditions (CDF Website).

A variety of measures are commonly used to protect visitor safety in fire-prone areas, including the study area. These measures include area closures, signage, brochures and pamphlets, interpretive programs, media reports, visitor registration, and public involvement in planning, among others (Mutch and Davis 1985). In the study area, several safety measures are in place at recreation sites to help prevent wildland fires. Education and site design are two of the primary fire prevention techniques used at study area recreation sites. Informational signs are used at developed recreation areas to educate visitors about the potential threat of wildland fires and techniques to minimize the possibility of a fire resulting from recreational activities. The developed recreation areas in the study area also provide hardened/constructed fire pits, barbeques, and grills to contain legal campfires and prevent escape and wildland fire. Hardened facilities and fuel management techniques, such as pruning and clearance zones (Figure 5.6-3), at developed recreation sites have been shown to help minimize the potential of a fire spreading and disturbing a larger area (DPR 2002; Hammitt and Cole 1998).

As the number of visitors to parks and recreation areas has generally increased over time, especially in fire-prone areas, the potential of life-threatening wildland fires has also increased (Mutch and Davis 1985). To continue to ensure visitor safety with regard to wildland fires in the study area, the following safety procedures should be considered to help prevent potential life-threatening wildland fires in the future (Hendee and Dawson 2002):

- Visitor contact near ongoing fires to communicate dangers and safety procedures;
- Consistent evaluation and monitoring of fire conditions and behavior to develop and revise (as needed) contingency plans;
- Communicating fire information (occurrence, status, actions, etc.) to nearby residents and visitors;
- Safety signage on roads, trails, and at recreation sites warning visitors of fire conditions; and

- Informational signs and pamphlets that educate visitors about fire safety and precautions.

For informational purposes, CDF response times to recreation sites and areas were obtained from CDF staff (Table 5.6-5). Overall, the majority of sites are estimated to receive CDF response in less than 7 minutes. Only two sites (Enterprise Boat Ramp [BR] and Dark Canyon Car-Top BR) were estimated to have response times greater than 15 minutes.

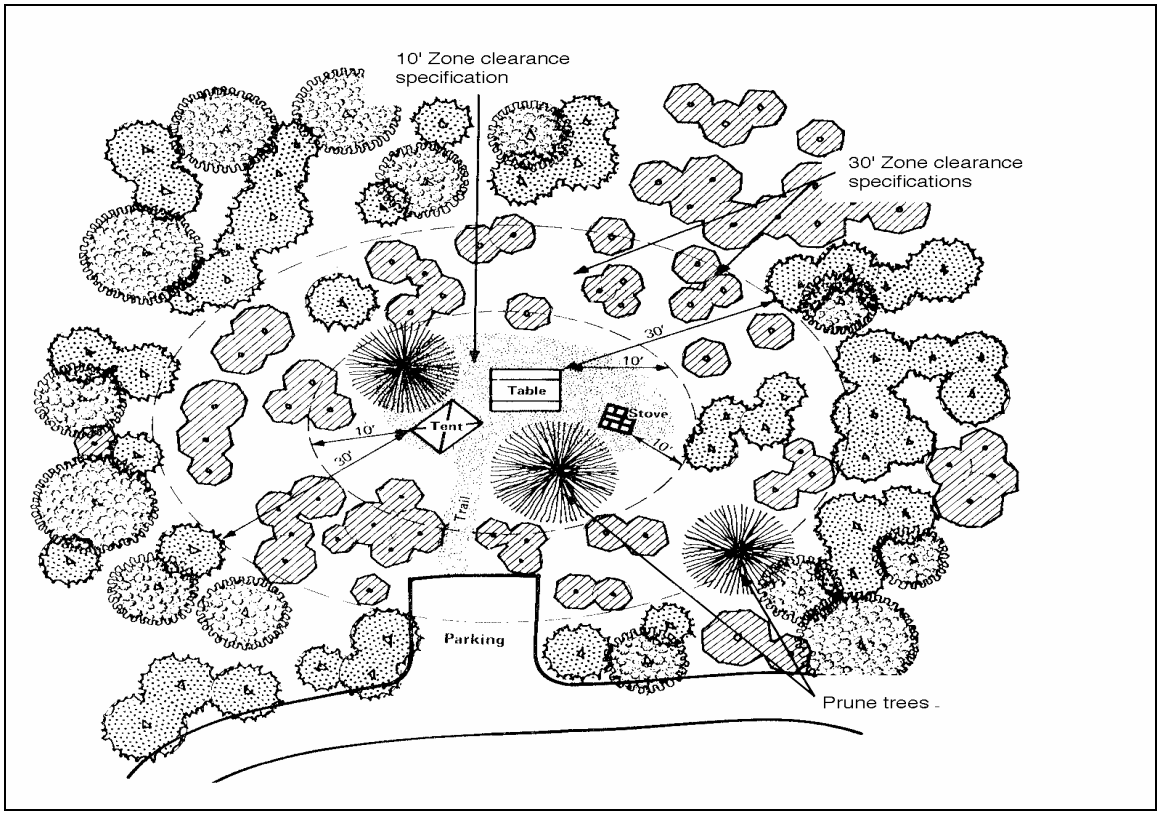

Figure 5.6-3. Recreation Site Fuel Management Techniques (DPR 2002).

Table 5.6-5. CDF emergency response times at Project recreation facilities.

Recreation Site	Emergency Response Times
Day Use Areas	
Bidwell Canyon Boat Ramp and DUA	Less than 7 minutes
Diversion Pool DUA	Less than 7 minutes
East Hamilton Trail Access	Less than 15 minutes
Feather River Fish Hatchery	Less than 7 minutes
Kelly Ridge DUA	Less than 7 minutes
Lakeland Blvd Trail Access	Less than 7 minutes
Lime Saddle Boat Ramp and DUA	Less than 15 minutes
Loafer Creek DUA	Less than 7 minutes
Model Airplane Facility	Less than 15 minutes
North Forebay DUA and Aquatic Center	Less than 7 minutes
Oroville Dam Overlook Area	Less than 7 minutes
OWA Afterbay Outlet	Less than 7 minutes
OWA Clay Pit Shooting Area	Less than 7 minutes
OWA Clay Pit Vehicular Recreation Area	Less than 7 minutes
OWA Headquarters	Less than 7 minutes
Powerhouse Road Trail Access	Less than 7 minutes
Riverbend Park	Less than 7 minutes
Saddle Dam DUA	Less than 7 minutes
South Forebay Boat Ramp and DUA	Less than 7 minutes
Spillway Boat Ramp and DUA	Less than 7 minutes
Campgrounds	
Bidwell Canyon Campground	Less than 7 minutes
Lime Saddle Campground	Less than 15 minutes
Loafer Creek Campground	Less than 7 minutes
Loafer Creek Equestrian Camp	Less than 7 minutes
Loafer Creek Group Campground	Less than 7 minutes
Boat Ramps	
Enterprise Boat Ramp	**15 minutes or more**
Loafer Creek Boat Ramp	Less than 7 minutes
Monument Hill Boat Ramp	Less than 15 minutes
Wilbur Road Boat Ramp	Less than 15 minutes
Car-Top Boat Ramps	
Dark Canyon Car-Top Boat Ramp	**15 minutes or more**
Foreman Creek Car-Top Boat Ramp	Less than 15 minutes
Larkin Road Car-Top Boat Ramp	Less than 7 minutes
Nelson Bar Car-Top Boat Ramp	**15 minutes or more**
Stringtown Car-Top Boat Ramp	**15 minutes or more**
Vinton Gulch Car-Top Boat Ramp	**15 minutes or more**

Source: CDF (2003)

6.0 PUBLIC SAFETY CONSIDERATIONS

This section presents suggestions by the authors regarding public safety in the study area to be considered during the relicensing process. The section is subdivided into five issue areas with the identified issues and public safety considerations noted: Administrative Issues, Land-Based Safety Issues, Boating-Related Safety Issues, Visitor Management Issues, and Wildland Fire Issues.

This report was prepared under the direction of DWR staff. Opinions, conclusions, and findings expressed in this report are those of the authors. This report does not express the official position of the DWR unless approved by the Director or his designee.

6.1 ADMINISTRATIVE ISSUES

Issue: Accident and Incident Reports and Statistics are Inconsistent. A review of incident and accident reports in this study revealed that agencies may respond to an incident but may not inform other responsible agencies. The results provided by different agencies were often inconsistent.

Public Safety Consideration: Could coordinate incident and accident reporting to allow for a comprehensive analysis of safety-related accidents and incidents over the term of the new license. This role could be carried out by the Area Control Center (ACC) operated by DWR. DWR could request that all area public safety agencies provide a periodic report of accidents and incidents that were related to Project facilities to the ACC. A comprehensive list of incidents and accidents could allow area land managers to identify significant recreation safety-related issues and to prioritize them over time.

Issue: Cellular Phone Coverage is Intermittent or Poor at Some Study Area Sites and Areas. If an incident were to occur at certain areas within the study area, response time could increase significantly if visitors are unable to alert authorities in a timely manner.

Public Safety Consideration: Could alert cellular providers to the limitations of their service coverage and work with them to improve cellular phone coverage and quality at recreation sites and areas that may currently have poor or intermittent coverage.

6.2 LAND-BASED SAFETY ISSUES

Issue: Public Safety Issues at Afterbay Outlet Fishing Area. The Thermalito Afterbay outlet area is a popular fishing spot with limited camping available that has been cited by DFG as having recreation safety issues. One issue cited is that the water flow from the Afterbay Outlet into the Feather River can be a potential drowning hazard, particularly during higher flows. There have been

reports of conflicts between anglers resulting in actions as extreme as firing gunshots. There is currently only one DFG game warden assigned part-time to DFG-managed lands in Butte County.

Public Safety Consideration: Could arrange for additional land-based DFG patrols. These patrols could concentrate on the Afterbay Outlet area, especially during the fishing season.

6.3 BOATING-RELATED SAFETY ISSUES

Issue: Daily Fluctuations in Water Depth at Thermalito Afterbay are a Potential Grounding Hazard for Boaters. Thermalito Afterbay has theoretical daily fluctuations of up to 8 feet, however daily fluctuations of less than 4 feet are much more common. These fluctuations are a result of Project operations. There are areas along the reservoir that are boatable one day, but the next day the water depth may be much shallower. There have been incidents where boats have run into submerged objects in areas they had boated on the day before with no problems. There is currently signage placed along the shoreline warning boaters about fluctuations, but some shallow areas do not have buoys. Safety issues also arise from visitors ignoring posted signs and regulations, and other manifestations of operator error.

Public Safety Consideration: First, could evaluate areas in the Afterbay where water fluctuations might lead to potential grounding of boats or contacts with submerged objects. Additional buoys in these potentially hazardous boating areas could help avoid the effects of water level fluctuations at Thermalito Afterbay. Could also re-emphasize the current visitor management program and/or modify it if necessary.

6.4 VISITOR MANAGEMENT ISSUES

Issue: Visitor Education Issues. There were complaints from recreation users (per the Recreation Survey) about boat operators following too close, boat operators not obeying speed regulations (no wake zones), alcohol use while boating, boaters not wearing PFDs, and conflicts with PWC. Area Land Mangers (DPR, DFG, and Butte County Sheriff's Office) also mentioned these issues. Additionally, according to the Recreation Survey, about 10-15% of the users were not aware of relevant hunting and fishing regulations. According to the Oroville Police Department, there have also been cases of hypothermia (in particular along the Feather River below the dam), even on very warm days.

Public Safety Consideration: Could re-emphasize the current visitor management (Interpretation & Education) program. Could provide additional education programs highlighting visitor safety issues including: importance of wearing PFDs and issues with alcohol use and boating. Could provide additional signage informing recreational users of regulations, especially those related to

PWC operation, hunting, and fishing. In addition, could provide additional signage warning potential swimmers of cold water at access points along the Low Flow Channel.

6.5 WILDLAND FIRE ISSUES

Issue: OWA Does Not Have a Wildfire Evacuation Plan. Even though there have been occasional wildfires in the OWA, there is currently no evacuation plan for recreational users. An evacuation plan can be an important visitor management program element in potential wildfire areas that receive significant recreational use.

Public Safety Consideration: A fire evacuation plan for recreational users in the OWA could be developed. Special attention could be paid to the Afterbay Outlet area, as a significant portion of the OWA recreational use occurs there. The complexity of the existing road network within OWA, and the level of dispersed use in this area, suggest the need for clearly communicating available evacuation routes to the public. Alternatively, consider closing the OWA to public use during periods of high or extreme fire hazard.

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